

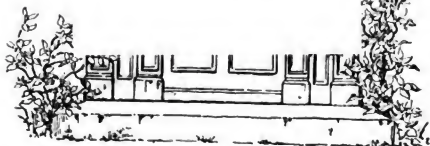


Our ferns in their haunts

Willard Nelson Clute



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OUR FERNS IN THEIR HAUNTS.



PLATE VII. THE OAK FERN. *Phlegopteris Dryopteris*.

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OUR FERNS IN THEIR HAUNTS

A Guide to all the Native Species

BY

WILLARD NELSON CLUTE

Author of "A Flora of the Upper Susquehanna"

ILLUSTRATED BY

WILLIAM WALWORTH STILSON



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" The feathery fern, the feathery fern,
It groweth wild and it groweth free,
By the rippling brook and the wimpling burn,
And the tall and stately forest tree ;
Where the merle and the mavis sweetly sing,
And the blue-jay makes the woods to ring,
And the pheasant flies on whirring wing
Beneath a verdurous canopy.

" The feathery fern, the feathery fern,
An emerald sea, it waveth wide,
And seems to flash, to gleam and burn,
Like the ceaseless flow of a golden tide ;
On bushy slope or in leafy glade,
Amid the twilight depths of shade,
By interlacing branches made
And trunks with lichens glorified."

PREFACE.

IN recent years there has arisen a widespread interest in ferns from the popular point of view, creating a demand for more detailed information regarding their haunts and habits than is found in the text-books devoted to the subject. It is the aim of the present volume to supply this information; and in such a manner that while conforming strictly to scientific canons, it shall make the way as smooth as possible for the beginner whose desire is, first of all, to know the names of the ferns.

Few families of plants are at once so generally admired and so little known. Many who have been attracted to their study by the grace and beauty of the individual species, have been prevented from continuing it by the apparent difficulties in the way. Although we have long had manuals from which the names of the ferns might be learned, the characters upon which the identification of the species is based are so different from those employed in the better known flowering plants, and the descriptions are written in such brief and technical language, that they have served to discourage all save the most persevering of students. As a matter of fact, ferns are probably easier to identify than flowering plants when one knows how, and the knowing how may be acquired with less labour.

After mastering the names of our ferns, the student who has desired to go deeper into the subject and learn something of their haunts, habits and folk-lore, has been

obliged to seek his knowledge in many books and periodicals, some of which are rare, others out of print, and the majority of foreign origin. A volume which would bring these scattered facts together in convenient form has been greatly needed.

In comparison with other countries, our fern literature is very limited. The history of American fern books begins in 1878 with the publication of John Williamson's modest little volume on the "Ferns of Kentucky." This went through three editions and has long been out of print. It is remarkable that the few years immediately following the appearance of this book should form our most prolific period as regards fern literature. In 1879 John Robinson issued his "Ferns in their Homes and Ours," a manual for the cultivator; in 1880 the first edition of Prof. Underwood's text book "Our Native Ferns" appeared and during the same period the two magnificently illustrated but expensive volumes of Prof. D. C. Eaton's "North American Ferns" were published. All of these have remained alone in their special fields. For nearly twenty years, no fern book that could compare with them in importance made its appearance. Several minor works, however, treating of the fern-flora of limited areas were published, chief among which may be mentioned Dodge's "Ferns and Fern Allies of New England," Lawson's "Fern-flora of Canada" and Jones' "Ferns of the West." Still more recently have appeared Mrs. Parsons' excellent "How to Know the Ferns" and Miss Price's "Fern Collector's Handbook." This completes the list of books, but a list of American fern publications would scarcely be complete without some mention of the *Fern Bulletin* which enjoys the unique distinction of being the only journal

in the world devoted exclusively to ferns. In its pages now appears the bulk of the periodical literature of ferns. Eight volumes have been issued.

In this book have been included descriptions and illustrations of every species known to grow in North America north of the Gulf States and east of the Rocky Mountains, this area forming a more or less natural floral region. With few exceptions they have been treated in related groups and arranged as nearly as possible according to season, those first to fruit coming first in the book. By means of the illustrated Key to the Genera it is believed that no one will have difficulty in ascertaining the name of any specimen he may find.

In view of the present unsettled state of botanical nomenclature, it has seemed best to adopt, in this volume, the botanical names longest in common use. They will certainly be less likely to confuse the beginner, since they are the names used by a majority of fern students and those by which the species are usually mentioned in other books. Botanists have recently proposed many changes in the interests of a more stable nomenclature, but these changes have not been generally accepted. Until they have been, they cannot properly be used in a volume of this nature. A complete account of these changes, however, has been inserted in the text for convenience of reference and in addition, a check-list has been included at the end of the book, which gives the other names by which the various species have been known in America.

The early botanists were mainly engaged in describing new species and have left for us the pleasanter task of discovering the curious and interesting facts about them. In this direction still lies a practically virgin

field. Our knowledge of spores and sporelings is far from complete; the prothallia of some species have never been seen; the phenomena of fern hybridization have scarcely been touched upon; while the study of the natural variation in species will afford much profitable work. There is also the ever delightful occupation of exploring unfamiliar territory and the possibility of thus adding to our knowledge of the distribution of species. The range of each species has been given in accordance with our present information, but it is expected that many will prove to be more widely dispersed and that some now marked rare will ultimately be found to be more abundant. I shall be pleased to receive further information upon these points and will also undertake to identify any ferns that may be sent me provided that good fruiting specimens with rootstock, when possible, be selected for the purpose.

In the preparation of this volume, I have had the hearty coöperation of American fern students and take this opportunity to express my indebtedness to them. My thanks are especially due to Mr. William R. Maxon for data regarding the range of many species, to Mr. George E. Davenport for verifying the nomenclature of the Check-List, to Mr. B. D. Gilbert for carefully reading the proof-sheets, and to Prof. L. M. Underwood for much valued information.

WILLARD N. CLUTE.

Binghamton, N. Y.

April 12, 1901.

THE UNCOILING FRONDS.

- " The green and graceful fern,
How beautiful it is,
There's not a leaf in all the land,
So wonderful, I wis.
- " Have ye e'er watched it budding,
With each stem and leaf wrapped small,
Coiled up within each other
Like a round and hairy ball ?
- " Have ye watched that ball unfolding
Each closely nestling curl
Its fair and feathery leaflets
Their spreading forms unfurl ?
- " Oh, then most gracefully they wave
In the forest, like a sea,
And dear as they are beautiful
Are these fern leaves to me."—TWAMLEY.

THE UNCOILING FRONDS.



THE first call of Spring awakens the ferns. Before the last snow-banks have vanished from the shady hollows and while meadows are still bare and the woods deserted, the impatient young crosiers begin to stir the dead leaves in sheltered nooks. By the middle of April, in this latitude, millions are putting forth. Some, like tiny green serpents, uncoil in the shelter of rock or fallen log; others hang from the shelves of mossy precipices; while still others boldly appear along woodland streams, in fence corners and in open thickets, and soon the whole under-wood is filled with their waving pennons.

When Thoreau wrote that "Nature made ferns for pure leaves, to show what she could do in that line" he voiced a thought which must often come to those who contemplate this beautiful race of plants. Whether it be a denizen of our own fields and woodlands or the lordly tree-ferns of the Tropics, we are obliged to confess that in these we have, indeed, "the proudest of all plants in the structure of their foliage." All the grace and beauty that may exist in mere leaves is here perfected and the title of "Nature's lacework" is well merited. Nature, however, is too clever to make all ferns beau-

tiful. There are many, especially in tropical countries, that are coarse and ugly, but so far as our own are concerned, the few plain species make very welcome foils for the others.



A CROSIER.

The fronds of a fern are essentially complete in the bud and their development into those graceful and delicate objects that wave in the summer breeze is mainly a process of unrolling and expanding.

In those species that produce their fronds in whorls or circles there may be seen within the circle of expanded fronds, several circles of buds, each successively smaller toward the centre. These are the fronds of coming years and strikingly remind us how many morrows the fern tribe is prepared for. Although known as fronds, these organs are really leaves and may be called leaves without impropriety. They are, however, more frequently called fronds, the expanded leafy portion being known as the *blade* and the stalk that supports it, the *stipe*. The continuation of the stipe through the blade, or beyond the beginning of the leafy portion, is the *rachis*. Since many species have no stipes, the use of the word *frond*, to designate the blade alone, is common. As regards the production of fronds, our species may be divided into two classes. In the one, they are produced only in spring unless

the first crop is destroyed, and commonly appear in circular clumps. This habit is nearly confined to species with short, stout, slowly creeping rootstocks. In the other, the fronds are produced throughout most of the summer. In the latter class, long, slender, extensively creeping and frequently branching rootstocks are the rule.

Nature's pattern for fern buds is the spiral. Indeed, so inflexible is she upon this point, and so rarely does she adopt a similar pattern for other plants, that this forms one of the chief characters by which the whole fern tribe may be identified. No matter how varied in outline or different in size the mature fronds may be, in the bud all true ferns are coiled like a watch-spring. And not only are the fronds as a whole coiled thus, but each of the remotest divisions is rolled toward the next largest, these in turn toward the rachis, and then, beginning at the apex, rachis and stipe are rolled down to the crown. During winter, the buds are protected from the cold and wet by a multitude of papery or hair-like scales, usually tawny brown in colour. When the fronds develop, these often remain upon stipe and rachis, adding not a little to the picturesque appearance of the crosiers. The down and hairs so common on the stems and leaves of flowering plants are comparatively rare in the ferns, scales taking their places.

There are nearly four thousand species of ferns in the world, but an examination of the rocks has shown that the present number is but a handful in comparison with those that flourished when the earth was younger. In the warmth and moisture of the long ago, they grew to a great size and with the allied club-mosses and scouring-rushes played an important part in the formation of the

coal measures. The presence of great beds of coal in lands that are now covered with ice and snow for a large part of each year, indicate that they once supported a luxuriant fern-flora. The temperature was then, of course, much higher. The tree ferns' descendants still retain their love for warmth, shade and moisture, and perhaps are still as abundant upon tropical islands as ever, but there is scarcely a spot on the globe without one or more species, unless it is an absolute desert.

Nearly all ferns are perennial, although individual fronds seldom live more than a year. Many, even in a climate like that of Canada, are evergreen. The tree-fern with an erect trunk and a tuft of fronds at the summit is probably the typical form. Our common species are supposed to be without trunks because they do not rise above the earth but one has only to dig up the nearest species to find that if it has not a true trunk, it has what is equivalent to one. This is usually a horizontal axis, bearing the crown of fronds at one end and giving off roots especially from the under surface. It is occasionally found upon the surface and seldom very far beneath it. In some the axis branches and in most the growing tip is advanced some distance each season, just as the crown of the tree-fern is lifted higher in air. The conditions under which our species exist, especially in winter, are not favourable to the formation of aerial trunks and they have therefore been modified for a life under ground.

Ferns bear no flowers,—although one species is by courtesy called the flowering fern—and “fern-seed” is still as elusive and uncertain a thing as it was in the time of the Ancients. Many absurd ideas were entertained regarding it, some of which are mentioned in the chap-

ters on the bracken and the lady-fern. As a sort of extension of the "Doctrine of Signatures" it was assumed that since the seed is invisible, it would render its possessor invisible also. It was supposed to have many other virtues, and could be obtained only by the exercise of the greatest care and endurance. An old legend accounts for the fern's lack of flowers by asserting that all ferns bore them until the Nativity. In honour of that event, the plants that were mixed with the straw in the stable put forth their flowers. The ferns, alone, did not, and were therefore condemned for ever afterward to be flowerless.



FLOWERING FERN.

Even the early botanists could not understand a process which in such a mysterious way produced new plants without the intervention of a flower. As late as 1828, Sir J. E. Smith wrote of the idea that ferns do not bear seeds, as follows:—"I see no advantage in applying a new denomination to the seeds of these and other cryptogamous plants. Hedwig gave the Greek name *spora* to the seeds of mosses because he conceived them to differ in their structure and germination in some indefinite manner from seeds in general. The most malicious rival of his immortal fame could not have imagined anything more subversive of that fame or of his luminous

discoveries." And again: "The production of perfect germinating seeds contained in capsules . . . is as clear in ferns as in mosses though nothing is certainly known of their stigmas any more than of their anthers. We are nevertheless content to plead ignorance on the subject and to presume by analogy that such parts exist, rather than to assume the idea of some other mode of impregnation, hitherto unknown, which would be going contrary to the first principles of Philosophy."

What really happens in the generation of new ferns, and the way it is accomplished, is as follows. About mid-summer, there appear upon the underside of the fronds of most species, numerous small dots very regular in size and shape. These are the "fruit-dots" or *sori* (singular, *sorus*) and under a simple lens are seen



SORI
OF
ASPLENIUM.

to be collections of tiny stalked globes. In the majority of cases, each sorus is covered with a membrane called an *indusium* which conceals the tiny globes until nearly ripe. In these globes, collectively called *sporangia*, are produced many smaller one-celled bodies known as *spores*. At maturity these "spore-cases" open, and with a snap scatter the spores upon the wind. Ordinarily they germinate soon after leaving the capsules if a suitable situation is encountered, but failing in this, some species are able to retain their vitality for nearly twenty years. Spores must not be mistaken for seeds, however. In no way do they resemble them except that they may serve to carry the species through a resting stage, as seeds do. When a seed is planted, a plant like the parent will come up, but a germinating spore does not give rise to a

fern. Instead, there appears a peculiar flat, green, heart-shaped body, scarcely a quarter of an inch across, known as the *prothallium*. On the underside of this are borne two sets of organs and finally by a union of their contents, a new fern is produced. It is small wonder that this complicated process was so long a puzzle to investigators of plants. The knowledge of the subject grew very slowly. In 1648 the nature of the sporangia was first made out, and in 1669 the spores themselves were discovered. In 1715 Morrison is said to have raised young plants from spores but it was not until 1788 that the office of the prothallium was known and more than thirty years later before its development was observed. Lastly it was not until near the middle of the nineteenth century that the functions of the small organs on the prothallium were discovered. The time required for a fern to come to maturity from the spore is from three to seven years.

As may be imagined, many dangers threaten the young sporeling, and some species have devised various "short-cuts" by which to avoid the perils that often seem to threaten the very existence of their race. One of the bladder ferns produces spores in abundance and in addition, little bulblets grow from the under surface of the fronds. The spores are scattered far and wide and may or may not land in a favourable place for germination, but the bulblets drop into the soil beside their parents, ready to form new plants. It is interesting to know that the first fronds from these bulblets are much



SORI OF POLYPODIUM.

more mature than the first ones from the prothallium and will produce spores much sooner, being "grown up" as one might say. In this plant, the bulbets seem to be the chief means of continuing the



VENATION OF A PINNA IN ASPIDIUM.

species, while the spores travel about seeking new territory. Some species send out stolons which form new plants at their tips; others produce tubers upon their roots that may become new plants; and still others root at the tips of the fronds.

None of them, however, are lacking in the ordinary means of propagation. A tropical species of *Nephrolepis* has both tubers and stolons. A frond that bears sporangia is called *fertile* to distinguish it from the unfruitful or *sterile* ones. In a large number of species the two are scarcely different, except for the presence of sporangia, but in others the fertile are more or less changed in appearance and reduced in size.

When the blade of a frond is divided entirely to the midrib, it is said to be *pinnate* and the divisions are called *pinnæ*. When the pinnæ themselves are divided to the midrib, the frond is said to be *bi-pinnate* and the second divisions are called *pinnules* or *secondary pinnæ*. When frond or pinna is not completely pinnate, it is said to be *pinnatifid* and the divisions are *segments*. A frond may be several times pinnate or pinnatifid in which case



" FIDDLE-HEADS."

we have *ultimate pinnules* or *ultimate segments* for the smallest divisions, though pinnule is often loosely used to designate them all.

Another peculiarity of fern fronds is the way in which they are veined. Instead of giving off branches at intervals, as in flowering plants the veins fork near the base and each fork may fork and fork again. Thus one vein is usually equal to any other in the frond. Commonly the veins do not connect with one another, when they are said to be *free*. If connecting they are said to be *anastomose* and the meshes of the net-work thus formed are termed *areolæ*.

Ferns are separated into families upon characters taken chiefly from the rootstock, the manner of veining, and the shape and position of the sori and indusia. The indusium is a remarkably unvarying feature, and of itself forms a kind of family escutcheon from which the genus can usually be determined at a glance. Thus the indusia in the *Polystichums* are circular; in the *Woodsias*, star-shaped; and in the *Aspleniums*, linear. The distinguishing characteristics of the other genera may be found by referring to the "key" at the back of the book.



THE OSMUNDAS.

“ Fair ferns and flowers, and chiefly that tall fern
So stately, of the Queen Osmunda named.
Plant lovelier in its own retired abode
On Grasmere’s beach, than naiad by the side
Of Grecian brook.”—WORDSWORTH.

THE OSMUNDAS.



AMONG ferns as among flowering plants, there are certain species that so persistently force themselves upon our attention as to make it almost impossible not to know them. The members of the *Osmunda* family belong to this class. From the time their stout woolly crosiers peep from the ground in spring until their pinnæ are mingling with the falling leaves of autumn, they are among the most conspicuous of our native species. In everything the family runs to extremes. Their rootstocks are the largest, their crosiers the woolliest, their fronds the tallest and their fruit the earliest. They are also as common as conspicuous. Every farmer and wanderer countryward is familiar with their graceful forms, although he may have no other name for them than "brakes."

The Cinnamon Fern.

The best known of the *Osmundas* is doubtless the cinnamon fern (*Osmunda cinnamomea*). It grows in nearly every piece of boggy ground in the Eastern States, neighbouring with the coarse herbage of the wild hellebore and skunk's cabbage, but is at its best in shaded swamps and wet open woodlands where it forms jungles of almost tropical luxuriance. Frequently it takes large

areas to itself, stretching away for long distances in level reaches of green.

The young crosiers or "fiddleheads" begin to peep up in plashy pastures before the grass has turned green and may be distinguished from all others by the dense coat of silvery white wool in which they are clad. As the weather warms and they expand into fronds, the woolly covering turns to a tawny hue and gradually falls away, although vestiges of it remain throughout the summer, scattered along the stipe and in little bunches at the base of each pinna.

The fertile fronds are first to appear, but long before they have reached maturity the sterile have sprung up and overtopped them. It is rare for any fern to produce its fertile fronds first, and in the rapid development of the sterile fronds this species seems striving to be like the rest. An examination of the crown when the fronds are uncoiling shows that the fertile and sterile fronds are borne in separate circles and that the fertile belong to the outer circle although at maturity they are invariably surrounded by the sterile ones. The exchange is effected by a sharp bend outward at the base of the sterile frond's stipe but is so little known that nearly every one believes the fertile fronds to belong to the inner circle.

Only one crop of fronds is produced each year, unless the first is injured or destroyed. The plant is not to be caught unprepared, however, for nestling at the crown of the rootstock are the buds for several years to come. This central portion in all the *Osmundas* is known as the "heart of Osmond." It is tender, crisp and edible, tasting somewhat like raw cabbage, and is easily obtained by pulling up the clump of half-developed fronds. The operation, of course, destroys the plant.



CINNAMON FERN. *Osmunda cinnamomea*.

When full grown, the sterile fronds are often six feet high with stipes a foot long, and spread out in circular crowns like shuttlecocks or great green vases. They are lanceolate or oblong-lanceolate in outline with twenty or more pairs of nearly opposite, lanceolate pinnæ cut nearly to the rachis into numerous oblong, rounded lobes. The fertile fronds are totally unlike them; in fact, in this species the difference between the two is probably greater than in any other American fern excepting, perhaps, the little curly grass. They are stiff, club like and cinnamon-coloured and are very noticeable in the greening swamplands of late spring. An examination of one of the woolly pinnæ composing these clubs will discover the counterparts of the ordinary green pinnæ of the sterile frond here reduced in area and covered with sporangia.



A FRUITING PINNA.

The fertile fronds are at first bright green. About the last week in May, just as they begin to assume the familiar brown hue, the spores are shed in myriads, the slightest touch sufficing to shake down a sage-green cloud. At this stage a pinnule presents a beautiful sight under a simple lens. The multitudes of tiny globes vary in colour from the deep green of the unopened spheres to the sulphur-yellow or rich brown of older empty ones. Many will be found partly open, disclosing the spores within. Most species have brownish spores, but those of the *Osmundas* are of a beautiful shade of green, due to the amount of chlorophyll they contain. Perhaps because of this rather perishable chlorophyll, they must germinate within a few days after they are shed or they will be

powerless to do so at all. A single frond will produce many millions of spores and although the conditions for growth seem just right when they are shed, the comparatively small number of mature ferns indicate very plainly that many dangers attend the sporeling. As soon as the spores are shed, the fertile spikes wither and have usually disappeared by the end of June.

Under the frosts of autumn the pinnae of the sterile fronds twist and curl, and turning brown, soon loosen from the rachis. The latter remains erect and bare all winter in marked contrast to some of the evergreen species in which, although the fronds continue green, the rachids early become unable to hold them erect.

The rootstock of the cinnamon fern is doubtless larger than that of any other American species. It is shaggy with the persistent bases of the fronds of other years and creeps along just at the surface of the soil, looking like a great shoe-brush half buried in the mud. The strong wiry roots are given off on all sides and many are obliged



to penetrate the bases of one or more stipes before entering the earth. One end of the rootstock is annually renewed by fresh crowns of fronds and the other as constantly dies. If no injury happens to the crown, there seems nothing to prevent a plant from living for centuries.

That some are very old, an examination of the rootstock will show. A medium sized specimen often exhibits the persistent bases of more than three hundred fronds, to say nothing of those that have decayed and disappeared.



THE CINNAMON FERN. *Osmunda cinnamomea*.

The *Osmundas*, like other large ferns, are commonly called brakes. The name, however, more properly belongs to the bracken which can show cause for bearing it. In some of the Eastern States they are also known as hog-brakes, the qualifying word given, apparently to indicate their superior size, just as the words dog, horse and bull are applied to other plants. Occasionally they are called snake-brakes, popular opinion ever associating ferns and serpents. Nothing, however, can better show how unfounded is the belief in connection with this species than the fact that the Wilson's thrush and the brown thrasher are fond of choosing a clump of it for a nesting-site, often building in the centre of the green vase. It is doubtless this species that is coupled with the serpent in the old rhyme

" Break the first brake you see,
Kill the first snake you see,
And you will conquer every enemy."

In the Old World it was once believed that biting the first fronds seen in spring would insure one against the toothache for a year. Our earliest species appear to lack such desirable properties.

Occasionally in a clump of this species one may chance upon a frond that is half-way between fertile and sterile. This is the form *frondosa*. It is seldom twice alike. The fertile portion may be at the apex, base or in the middle, or scattered about the frond. It may be common in a locality one season and rare the next. It is apparently caused by some injury to the rootstock which obliges the plant to turn the partly formed fertile fronds into organs of assimilation and is of special interest to the botanist for the relation it shows to exist between the two sorts of fronds.

The cinnamon fern is fairly well distributed in Eastern America from Nova Scotia to Florida, Mexico, Nebraska and Minnesota. It also grows in the West Indies. I have collected it in Jamaica at an altitude of 4,000 feet where it flourished in a sphagnum swamp, in company with the stag-horn club-moss in the shelter of gigantic bamboos. This species is in all probability the best known of our native ferns.

The Interrupted Fern.

Although the first of the *Osmundas* to appear in spring and fairly abundant in northeastern America, the interrupted fern, (*Osmunda Claytoniana*) seldom becomes a reality to the casual observer because of its remarkably close resemblance to the cinnamon fern. Fairly good observers have been known to pass it for years, under the impression that it was only a peculiar form of the latter. When both plants are in fruit, there is no chance of confusing them, but when only sterile fronds are to be had, they are not easy for the young collector to separate. Further acquaintance, however, will disclose many little points of difference. The experienced collector can distinguish either species at a glance.

The interrupted fern is less a lover of moisture than its kindred, and while it may occasionally be found with the cinnamon fern in some springy spot in the open grove, its preference is for the fence-row and the bushy half-wild lands that border so many of our back country roads. Here it often thrives in the face of the most untoward circumstances, frequently perched upon the top of a half-buried stone pile, through the interstices of which its strong roots ramify to the soil below. It is



INTERRUPTED FERN. *Osmunda Ceytoniana*.

from some such situation as this that the wise fern cultivator selects his plants for the garden, for the labour of removing the stones from about the prize is much less than is required to dig it up when growing in the soil. It is as firmly anchored as any of its relatives and does not come up whole without a struggle.

Both kinds of fronds begin to grow at about the same time. Although they are so nearly like those of the cinnamon fern, the eye begins to note slight differences even before the frond has unrolled as far as the blade, for the stipes are greener, slenderer and less downy. The sterile fronds grow from a circle inside the fertile ones, but as in the cinnamon fern they are on the outside at maturity. The fertile fronds are usually taller than the sterile and remain green all summer. Both kinds are oblong-lanceolate in outline with about twenty pairs of pinatifid round-lobed pinnæ. The spore-bearing organs are produced near the middle of the frond and consist of from two to seven pairs of transformed pinnæ that look as if they might have been bodily transferred from the spike of the cinnamon fern. They look so out of place in the middle of the green blade that the uninitiated often take them to be dwarfed or blasted pinnæ



INTERRUPTED FERN.
Osmunda Claytoniana.
Fertile frond.

although in reality they are the most essential part of the frond. The sterile fronds are broader and blunter than those of the cinnamon fern and also lack the little tuft of wool at the base of each pinna.

The fruiting pinnæ are at first dark ashy-green and at a short distance appear almost black, in pleasing contrast to the golden-green of the rest of the frond. The spores are often ripe before the tips of the fronds have unfurled and the parts that bear them soon turn brown and wither away. This species frequently presents curious transitions between fertile and sterile fronds. Sometimes all the pinnules on one side of the midrib will be fertile and those on the other side, sterile; or the dilated green sterile pinnules will be scattered among the contracted and brown fertile ones. Occasionally spores are borne on the underside of the frond after the manner of the polypody and most of our common ferns.

A strong plant will often bear fifteen fronds, half of which are fertile. The sterile spread broadly outward but the fertile are nearly erect with only the tips, spreading, making two tiers of green, the taller with a pretty palm-like effect.

In folk-lore, the interrupted fern shares the honours with the cinnamon fern, being so near like it. It is found from Newfoundland to North Carolina, Missouri and Minnesota and is reported to grow in India. From the appearance of the fertile frond it was once called *O. interrupta*. Its preference for stony soil is very evident. With us it is sometimes called Clayton's fern.

The Flowering Fern.

The flowering fern (*Osmunda regalis*) is the only member of its tribe that is common to both Europe and



THE INTERRUPTED FERN. *Osmunda Claytoniana*.

America. Across the sea it is regarded as their handsomest species and Withering alludes to it as the "flower-crowned prince of British ferns." We who have the ostrich fern, the *Dicksonia* and the cinnamon fern may not be willing to accord the palm to this species although it cannot be denied that it is a beautiful object when growing in suitable situations with room for its fronds to develop. The name of water fern, sometimes applied to it, indicates its fondness for moist situations. It loves to stand in shallow water and will generally be found in places too wet for its kin.

The rootstock is frequently erect and, although it seldom rises more than a foot above the surface, has gained for the plant the name of tree-fern in some localities. As the uncoiling fronds begin to rise from the watery earth, the cobwebby wool that invested the cro-siers falls away in patches, revealing the glaucous wine-coloured stipes with their burden of pink or ochre pinnæ. As these expand, the bright green spore-cases may be seen for some time before the uncoiling has reached them, peeping through the sterile pinnæ which clasp them like chubby hands.

Full grown fronds often reach a height of six feet and even taller specimens are recorded from England. These great cool-green, twice pinnate fronds have little resemblance to those of the other *Osmundas*, or for that matter to any other of our native species. The stout shining stipe continues through the blade as the rachis, giving off at intervals from five to nine pairs of opposite branches. These in turn bear six or more pairs of oblong pinnules with finely serrate margins and heart-shaped or oblique bases. The pinnules are usually slightly stalked and those on one side of the midrib

alternate with those on the other. The pinnæ and pinules are set at some distance from each other giving the whole frond a light and graceful appearance.

The flowering fern produces a single crop of fronds each season and forms a clump that is more pyramidal than vase-like in shape. Apparently its lighter, looser foliage makes it unnecessary for its fronds to spread to catch the light. The rootstock often gives off short



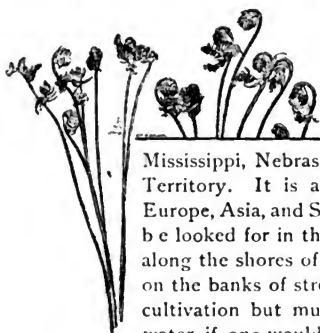
SPORE-CASES.

branches which form new crowns of fronds close to the original one. Sterile and fertile fronds are alike, except that in the latter the several pairs of pinnæ composing the upper part of the frond are changed to spore-bearing organs after the manner of the interrupted fern, and like it, showing many curious gradations between fertile and sterile pinules. Forms have been reported with fertile pinules in the middle of the frond. The fruiting panicle is bright green until the spores ripen. It then becomes rich brown in colour and bears no small resemblance to a panicle of small flowers, whence the well known common name. The spores, as in the other *Osmundas*, are green.

This species has probably received more common names than any other. Royal fern, regal fern, king fern, and royal Osmund have doubtless been prompted by the same feeling that led Linnaeus to give it the name of *regalis*. Ditch fern is doubtless in allusion to its growing near water, while buckthorn or buckhorn brake probably has reference to the appearance of the crosiers. It has also been called French bracken, royal moonwort, and St. Christopher's herb, the latter connecting it with the legend of St. Christopher.



FLOWERING FERN. *Osmunda regalis*.



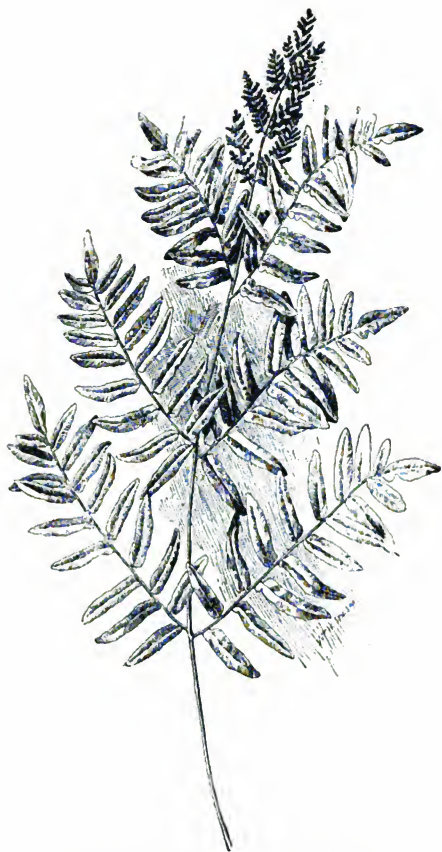
The flowering fern is pretty generally distributed from New Brunswick to

Mississippi, Nebraska and the Northwest Territory. It is also found in Mexico, Europe, Asia, and South Africa. It should be looked for in the half shaded swamps along the shores of lakes and ponds and on the banks of streams. It will grow in cultivation but must be given plenty of water if one would have it produce the great fronds that constitute its chief beauty.

This species was named from European material. American plants present some slight differences, especially in the texture of the frond and the proportionate length of the stipes and may yet be proven to be a different species. In this event, our plant would be called *O. spectabilis*, having been described under this name by Willdenow.

Authorities are not agreed as to the derivation of the word *Osmunda*. According to Prof. Underwood, it is from Osmunder a Saxon name for the god Thor. Others derive it from "Osmond the water-man" of Loch Tyne, who is reported to have hidden wife and child from the Danes on an island covered with this fern. Prof. Meehan has also pointed out that during the middle ages nodules of iron ore were known as "Osmonds." Since these frequently contained impressions of our fern he suggests that the name may have originated in this way. There are six species in the genus, mostly in the North Temper-

ate zone. With two additional genera, of which we have no representatives, they form the Order Osmundaceæ which differs from other fern-families principally in the structure of the sporangia.



FLOWERING FERN. *Osmunda regalis*.

THE RATTLESNAKE FERN AND THE
ADDER'S-TONGUE.

" The leaves of adder's-tongue stamped in a stone mortar and boiled in olive oyle unto the consumption of the juice, and until the herbs be dried, and parched and then strained, will yelde most excellent greene oyle or rather balsame for greene wounds comparable to oyle of St. John's-wort if it do not farre surpass it."—GERARDE.

THE RATTLESNAKE FERN AND THE ADDER'S-TONGUE.



ADMIRERS of ferns have always been puzzled to understand why ferns and serpents should be so indissolubly joined in popular opinion. Just as the average individual imagines every species of snake to possess fangs and venom and regards it as something like a duty to kill it, so does he consider ferns to be the natural protectors of these creatures and to be shunned accordingly. This suspicion of the ferns may not have originated as early as our antipathy to serpents, but it seems scarcely less deeply rooted in human nature. We have hardly passed the age when ferns were supposed to be endowed with the power to work charms, discover treasure and terrorize devils. It is possible that the mysterious way in which they reproduce their kind without visible flowers and seed and the haunts they affect in the dank thickets and gloomy ravines have contributed to keep alive the superstitions concerning them; but whatever the cause, several of these harmless plants are still known as snake-brakes while the two to be mentioned in this chapter have been singled out as special objects of aversion.

The Rattlesnake Fern.

Probably there is no fern in whose haunts serpents of any kind are less frequent, than the species which bears

the terrifying name of the rattlesnake fern (*Botrychium Virginianum*). It is a woodland species but by no means to be charged with harbouring the venomous serpent for which it is named. It delights in dim moist hollows, and is quite impatient of the sun, soon disappearing from a locality when the protecting trees are removed.

In southern New York, the single fronds of this species begin to push up about the last week in April. Unlike higher types of ferns, they are folded rather than coiled in the bud and come out of the earth almost erect. Many suppose that each plant has two fronds, a fertile and sterile, but this is a mistake. There is but a single frond divided into a fertile and sterile portion. The sterile half expands soon after it appears above ground but the fertile is most deliberate and requires fully a month longer to mature. In June the spores are produced and then, having fulfilled its mission, the fruiting part begins to wither. It often disappears by July, although vestiges of it may be found on the frond all summer.

This species is often three feet high and when full grown is a handsome plant. The sterile blade, borne some dis-



SPORANGIA.

tance above the earth by the fleshy stipe, spreads horizontally in a broad flat triangle, and above it the fertile portion rises several inches. The blade is usually described as ternate, but it is easily seen that two of the three divisions are really the enlarged lower pair of pinnæ. Calling these pinnæ, the frond is quadripinnate; or tripinnate with pinnatifid pinnæ below, and once or twice pinnate with pinnatifid pinnæ above. The segments are about ovate in outline. The fertile part is two or three times pin-



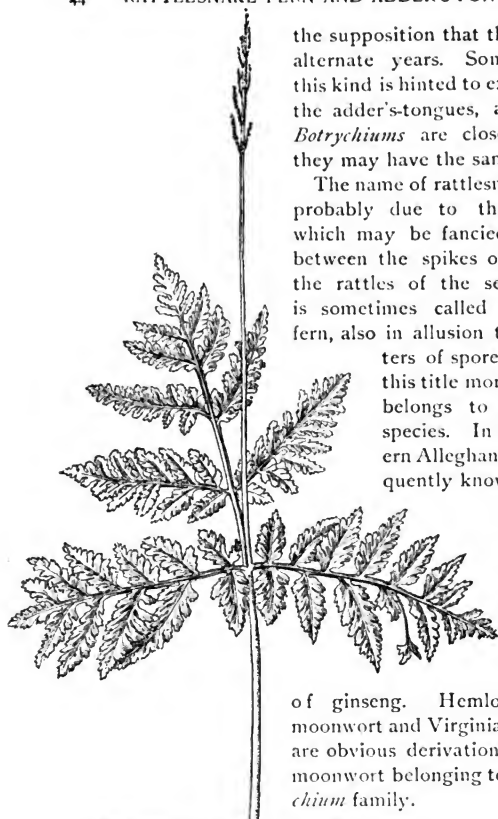
RATTLESNAKE FERN. *Botrychium Virginianum*.

nate with double rows of sporangia along the midribs. Occasionally a plant bears two fertile spikes. The spores are abundant, bright yellow, and escape from the capsules through a narrow transverse slit. The blade is noticeably thin and when dried is exceedingly delicate.

The rootstock is scarcely discernible, the stipe seeming to spring from a tangle of thick fleshy roots radiating horizontally a few inches underground. Next year's leaf bud is enclosed in a hollow in the side of the growing stipe at base, and its tiny stipe encloses a still smaller bud which in turn encloses another, the latter destined not to develop for three years to come. According to Campbell's "Mosses and Ferns," the development of the sporangia begins fully a year before the spores are shed.

Within our limits, this species never has more than a single frond, except by accident, but in the West Indies it normally appears with two. The author of the "Ferns of Jamaica" remarks, "There are two fronds to each plant, one without and the other with, the fertile division." The writer, who recently collected fine specimens in the Blue Mountains of Jamaica, discovered, however, that the fern is still true to its habit of producing but one frond a year. The frond lacking the fertile division proves to be the frond of the preceding year which the mild climate allows to remain green until the next frond is produced. The scar left by the withering of the fertile spike is quite noticeable.

Another peculiarity of this species is the great disparity in the size of fruiting plants and in the large proportion of apparently full-grown specimens that are sterile. Some bear fruit when but a few inches high, but others near by, twice as large, do not. The cause of this sterility in the large plants is unknown unless it may be explained upon

RATTLESNAKE FERN. *Botrychium Virginianum*.

the supposition that they rest in alternate years. Something of this kind is hinted to exist among the adder's-tongues, and as the *Botrychiums* are closely allied, they may have the same habit.

The name of rattlesnake fern is probably due to the likeness which may be fancied to exist between the spikes of fruit and the rattles of the serpent. It is sometimes called the grape fern, also in allusion to its clusters of spore-cases, but

this title more properly belongs to a related species. In the southern Alleghanies it is frequently known as "in-

dicator" from the supposition that its occurrence indicates the proximity

of ginseng. Hemlock-leaved moonwort and Virginia moonwort are obvious derivations, the true moonwort belonging to the *Botrychium* family.

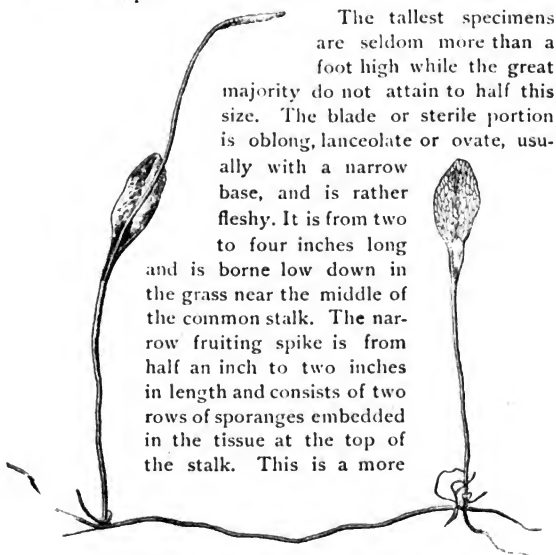
Our plant is found from New Brunswick to the Tropics and the Pacific Coast. Throughout most of this region it is fairly common. It has numerous relatives but none resemble it enough to be mistaken for it. It grows readily in cultivation if given shade, moisture and a light soil. Specimens that have been considered indetical with our plant have been reported from Europe and Asia.

The Adder's-Tongue.

It is safe to say that the adder's-tongue (*Ophioglossum vulgatum*) is much better known to the collector from pictures and herbarium specimens than it is from experience in the field. Although the plant is widely distributed and when found at all is likely to be abundant, the many who have carefully and unavailingly searched their localities for it are quite willing to admit that this abundance is not general. Still, it may happen after all, that the plant has only been overlooked, for it is not conspicuous, and some day when least expected may appear. So the search continues. All who have once found it, testify to the ease with which they subsequently find other stations for it, and incline to the belief that its single leaf is often passed under the impression that it is the leaf of some flowering plant, such as *Pogonia* or the two-leaved Solomon's seal. It seems a plant that one must first discover by accident before he can find it by intention.

Doubtless the most promising place to look for it is among the grasses and sedges in moist meadows, but upon this point there is considerable difference of opinion. Some years ago, several writers gave their experience in collecting it, in the *Fern Bulletin*. One wrote that in northern New York, he found it in "dry pastures, on and

about hummocks of hemlock loam " and added " it is seldom found in moist places." Another in Vermont says " in old meadows, they will grow in little hollows where it is richer and more moist " while still another in Kentucky found it common " in dry open woods " and writes that " it may safely be looked for in red cedar groves," adding, " I know few such places where it does not grow." In contrast to these, Mr. A. A. Eaton has found fine large plants in seven inches of sphagnum moss in New Hampshire swamps.



ADDER'S-TONGUE. *Ophioglossum vulgatum*.



PLATE I. THE ADDER'S TONGUE. *Ophioglossum vulgatum*.

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primitive way of bearing spores than is found in most ferns and is considered an indication that the *Ophioglossums* are very ancient forms.

The rootstock is short and produces many short fleshy roots. Here and there adventitious buds may be formed upon them and new plants result. In some species in this genus, this is said to be the chief method of propagation. The prothallia are apparently seldom developed, perhaps because this way of getting new plants is so much surer. The curious manner in which the adder's-tongue appears and disappears in the same spot in different years has given ground for the belief that the plants occasionally rest for a season. It is also conjectured that the prothallia may form resting bodies as the prothallia of certain other species of ferns are known to do.

In 1897 a party of botanists found a colony of small *Ophioglossums* in southern New Jersey, specimens of which were subsequently described as *O. arenarium*. This is apparently only a depauperate form of the common species due to the sterile soil in which it grows. It is described as about half the size of *vulgatum* with a rather lanceolate sterile portion in which there are from five to seven basal veins. The describer writes of it "It seems a little difficult to tell some of the young fronds of *O. vulgatum* from the mature ones of *O. arenarium*, and yet the extremes are so different and the habit and habitat so distinct that I have concluded to retain them as separate species. That *O. arenarium* has originated from *O. vulgatum* and that intermediate forms may be found in young or poorly developed specimens, does not alter the view from the modern standpoint of evolution." It is probable that the majority of botanists would consider this more properly placed as *O. vulgatum arenarium* and not as a separate species.

In America the adder's-tongue is found from Canada to Florida, Missouri and sparingly to California. In the Old World it occurs in Europe, Asia, Africa and Australia. Considering its wide distribution, some difference in specimens from remote points may be expected. In the western part of our range, there is a form named *Engelmanni*. It may be distinguished from the type by the slender stipe and apiculate sterile portion with broad areolae and anastomosing veins. It is found as far east as Virginia. This also is probably a form of *vulgatum* and better characterised as *O. vulgatum Engelmanni*.

The common name of adder's-tongue is much older than the scientific *Ophioglossum* and both have the same meaning. Adder's-spear, adder's-spit and other names formerly in use, all refer to a fancied resemblance between the plant and the adder. The fronds were long used as the principal ingredient in "adder's-spear ointment" to make which they were boiled with unsalted butter. Drayton alludes to its use in the lines

"For them that are with newts, or snakes or adders stung
He seeketh out a herb that's called adder's-tongue,
As Nature it ordained its own like hurts to cure,
And sportive, did herself to niceties inure."

There are about twenty species of *Ophioglossum* known. In northeastern America, there is but a single species unless the two forms noted should prove distinct. Three other species are sometimes found in tropical parts of the United States.

THE MOONWORT AND ITS ALLIES.



THERE is an herb, some say,
whose virtue's such
It in the pasture, only with
a touch
Unshoes the new-shod steed."

Withers.

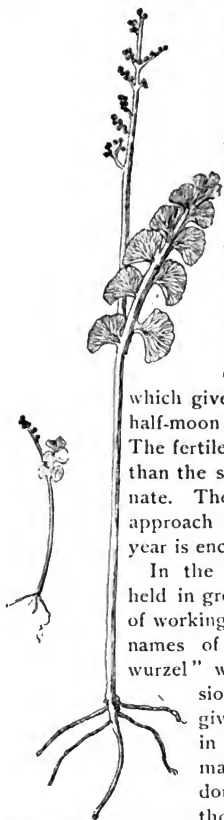
THE MOONWORT AND ITS ALLIES.



WITH the exception of the rattlesnake and common grape ferns, the members of the *Botrychium* family, although somewhat widely dispersed in eastern America, are very little known, even to the botanizing public. In the books they are usually set down as rare, but whether this is really the case, or whether their small size enables them to escape observation, it is difficult to say. It is possible to find most of our ferns by diligent search in suitable situations but the *Botrychiums* usually elude such attempts to discover them and are likeliest to appear when one is looking for something else. Once discovered, they are often found in considerable numbers and are not rare in collections, although comparatively few have seen them growing.

The Moonwort.

The moonwort (*Botrychium Lunaria*) is a fat little plant that delights to grow in old fields in many parts of the world but is exceedingly rare in the United States. Like all the *Botrychiums* it bears but one frond annually, divided after the usual manner into a fertile and sterile portion. This comes up out of the earth stiff and erect although the tip of the sterile part is slightly bent down-

MOONWORT. *Botrychium Lunaria*.

ward as if half inclined to coil after the manner of the true ferns. It seldom grows more than a few inches high, twelve inches being probably the maximum height. The blade is usually sessile, longer than wide, and borne at or above the middle of the stem. It is usually pinnate, though somewhat disposed to vary, and has from two to eight pairs of lobes or pinnæ which may be set close together or some distance apart. In outline, they are fan-shaped, or with a rounded outer edge which gives them enough the shape of a half-moon to suggest the common name. The fertile division is sometimes no longer than the sterile and is twice or thrice pinnate. The frond is annual, dying at the approach of winter. The bud for the next year is enclosed in the base of the stipe.

In the Old World, this plant was once held in great repute for its supposed power of working all sorts of wonders. Its old names of "blasting-root" and "spring-wurzel" were given it under the impression that the strongest locks would give way if it were merely brought in contact with them. To a more matter-of-fact generation it will doubtless seem strange that no one thought to make a test of its pow-

ers and so set the matter at rest. The old botanist, Culpepper, who wrote about 1650, says of the moonwort's reputed power to unshoe horses "Moonwort is an herb which they say will open locks and unshoe such horses as tread upon it; 'these some laugh to scorn, and these no small fools neither, but country people that I know, cal it Unshoe the Horse; besides I have heard commanders say that on White down in Devonshire near Tiverton there were found thirty hors-shoes pulled from the feet of the Earl of Essex, his horses being there drawn up in a body, many of them but newly shod and no reason known which caused much admiration; and the herb described usually grows upon heaths." Another ancient writer has done the idea into rhyme, as follows:—

"Horses that feeding on the grassy hills,
Tread upon moonwort with their hollow heels,
Though lately shod, at night goe barefoot home,
Their maister musing where thir shooes be gone.
O moonwort, tell us where thou hid'st the smith
Hammer and pincers thou unshodst them with.
Alas, what lock or iron engine is't
That can thy subtile secret strength resist,
Sith the best farrier cannot set a shoe
So sure, but thou so shortly cans't undoe."

There was, however, some protest against these beliefs as may be seen from this quotation from Parkinson. "It hath beene formerly related by impostors and false knaves, and is yet believed by many, that it will loosen lockes, fetters and shoes from those horses feete that goe in the places where it groweth; and have been so audacious to contest with those who have contradicted them, that they have been known and seene it to doe so; but what observation soever such persons doe make, it is all but false suggestions and meere lyes." Accord-

ing to the "Doctrine of Signatures" the shape of its pinnules showed this plant to be under the influence of the moon and therefore good for all diseases of a periodic character and especially valuable for the cure of lunacy which was supposed 'in some way to be caused by that luminary. To be efficient, it had to be gathered at full moon and by its light.

"Then rapidly with foot as light
As the young musk roe's, out she flew,
To cull each shining leaf that grew
Beneath the moonlight's hallowing beams."

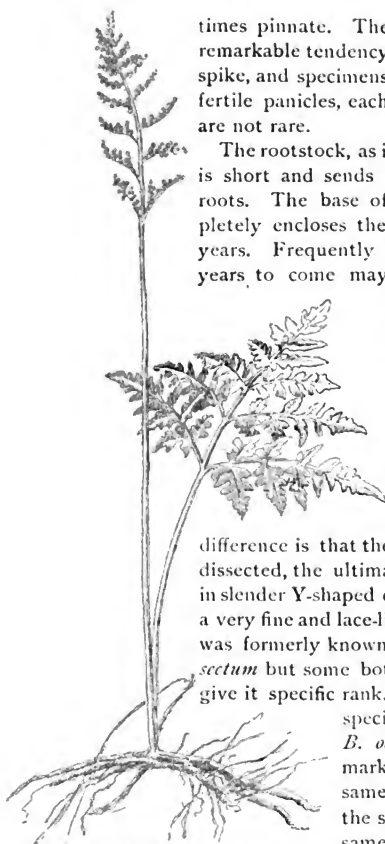
The moonwort is a boreal species. It is found in Greenland, Alaska and in the United States as far south as Connecticut, New York, Michigan and Colorado. Near its southern limits it is extremely rare, the records usually resting upon a very limited number of specimens. In British America it is said to be not uncommon. It is also found in Northern Europe and Asia. Across the water its habitat is given as "open heaths, moors and elevated rocky pastures." It is regarded as "local, rather than rare" in England.

The Common Grape Fern.

The common grape fern (*Botrychium obliquum*) is not rare in eastern America, but owing to its retiring disposition cannot always be found when wanted. It delights to grow in half-cultivated lands where some friendly rock or stump protects it from the tread of cattle and the implements of the farmer. One often finds it as he climbs over an old stone wall or crosses a bushy pasture, especially if the spot be moist, but on other occasions he may search the countryside in vain for specimens.

The triangular, much divided blade and heavy fruiting panicle of this species gives it considerable superficial resemblance to the rattlesnake fern but there is little chance that they will be confused in the field. The rattlesnake fern has shed its spores and the fertile part has withered and gone, long before the grape fern has thought of coming up. Of all our species, this is latest to appear. Often it does not start into growth until late in July and the spores are not ripe until September or October. It also has the distinction of being our only evergreen *Botrychium*. At the approach of cold weather the fertile portion decays while the sterile merely takes on a rich bronze hue and braves the frost and snow. In late fall and early spring it is quite conspicuous and the collector often locates his specimens at such seasons, returning later to collect them. The old frond usually remains until the new one has developed, just as that of the rattlesnake fern does, further south.

The grape fern is from six to eighteen inches in height and quite fleshy. The blade approaches the triangular in outline and springs from the common stalk near the base. It is itself long stalked, the latter feature serving to distinguish it from its allies in northeastern America. There are six or more pairs of stalked pinnæ each of which is again pinnate with lobed or incised pinnules. The blade is frequently described as ternate, because the lowest pair of pinnæ are nearly as large as the rest of the frond. The pinnules and segments are quite variable in shape and cutting and these differences are often considered of sufficient importance to warrant the making of numerous varieties or even species. The sterile part of the frond spreads nearly horizontally but the fertile is much taller and quite erect. The latter is about three

COMMON GRAPE FERN. *Botrychium obliquum*.

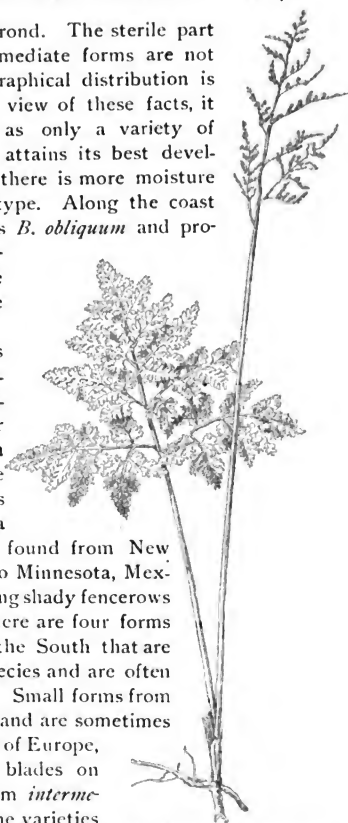
times pinnate. The plant often shows a remarkable tendency to double the fertile spike, and specimens with three complete fertile panicles, each on a separate stalk; are not rare.

The rootstock, as in all the *Botrychiums*, is short and sends out numerous fleshy roots. The base of the living stipe completely encloses the buds for succeeding years. Frequently the buds for four years to come may be discerned. The rootstock is reported to occasionally bear two fronds as the adder's-tongue does.

Throughout most of the grape fern's range, especially near the seaboard, there is an interesting variety whose principal difference is that the foliage is very finely dissected, the ultimate segments ending in slender Y-shaped divisions, that give it a very fine and lace-like appearance. This was formerly known as the variety *dissectum* but some botanists now incline to give it specific rank. If this is a distinct species, its resemblance to *B. obliquum* is truly remarkable. It affects the same habitats, fruits at the same time and has the same trick of waiting until

July to produce its new frond. The sterile part is also evergreen. Intermediate forms are not uncommon and the geographical distribution is essentially the same. In view of these facts, it seems best to regard it as only a variety of *obliquum*. It probably attains its best development in places where there is more moisture than is agreeable to the type. Along the coast it is nearly as plentiful as *B. obliquum* and produces luxuriant deeply-cut blades. Inland the blade tends to become less dissected.

Until recently botanists have considered our species a variety of *Botrychium ternatum*. The latter was discovered in Japan by Thunberg and there seems to be good reasons for believing ours to be a different species. It is found from New Brunswick and Ontario to Minnesota, Mexico and Florida, frequenting shady fencerows and swampy woods. There are four forms in the West and one in the South that are closely related to our species and are often classed as varieties of it. Small forms from New York and New England are sometimes referred to *B. Matricariæ* of Europe, and a form with larger blades on shorter stalks is the form *intermedium*. The species and the varieties



Botrychium obliquum dissectum.

take kindly to cultivation if taken up with plenty of soil and, after replanting, left to themselves. They resent any digging about their roots.

The Little Grape Fern.

The little grape fern (*Botrychium simplex*) is among the rarest of our *Botrychiums*. Whether this is alone due to its small size, or whether it really is rare in the southern part of its range, we have scarcely enough data to decide. It has been reported from a few localities in Massachusetts, Connecticut, New York, Maryland and Wyoming and appears to increase in numbers as we go northward. In Dodge's "Ferns and Fern Allies of New England," it is reported as "abundantly scattered over Vermont, its habitat usually poor soil, especially knolls of hill pastures." By others the habitat is given as "moist woods, meadows and swamps."



LITTLE GRAPE
FERN. *Botrych-*
ium simplex.

Mature plants are usually less than three inches high although luxuriant specimens may reach twice that height. The plant has a reputation for being extremely variable as may be judged from this description taken from a recent botanical work. "Sterile portion ovate, obovate or oblong, entire. Lobed or pinnately parted, borne near the base of the stem or higher, sometimes above the middle; fertile portion a simple or slightly compound spike, sometimes reduced to only a few sporangia. Spores large for the genus." Six varieties have been described but it is not difficult to select a complete suite

of intergrading specimens. The plant is quite fleshy and usually has the sterile part stalked and attached to the main stem near the base. It also occurs in Europe.

The Lance-Leaved Grape Fern.

In some parts of its range, the lance-leaved grape fern (*Botrychium lanceolatum*) is very abundant but it is not uncommon for collectors to search for years without finding it. As yet, comparatively little is known about its habitats. In Canada it is said to grow on "the shaded mossy banks of streams and in rich moist woods and low pastures." In central New York it is reported to be found "in shade, but generally in shaly soil that is almost barren of undergrowth and has but a slight covering of vegetable mould." In Pennsylvania the author has seen hundreds of these plants growing in the rich moist hollows of beech and maple woods at an altitude of about 2,100 feet.

The underground portion of this species consists of a tangle of stout roots, one of which, descending perpendicularly, gives off irregular whorls of other roots, at intervals. Single roots are frequently several times longer than the part of the plant above ground. The frond is somewhat fleshy and from three to nine inches high with the sterile division sessile near the top of the stem. It is somewhat triangular in outline with two or more



LANCE-LEAVED
GRAPE FERN. *Botry-*
chium lanceolatum.

pairs of opposite pinnæ, the lowest pair, of course, much the largest, as befits a *Botrychium*. The pinnæ are themselves usually pinnatifid with lobed or sharp-toothed segments, but show a decided tendency to vary. In general aspect, the blade resembles a very small specimen of the rattlesnake fern. The fertile portion but slightly overtops the sterile and is twice or thrice pinnate. In the southern part of its range, the spores are ripe about the last week in July.

Botrychium lanceolatum is found from New Jersey, Ohio, Colorado and Washington to the far north. Southward it appears to be an upland species and should be sought in moist level stretches of deciduous woods. In such places it is often found very plentifully over several acres. One of its constant companions is the rattlesnake fern. The species is also found in both Europe and Asia. The illustrations for this and the following species were drawn from specimens collected by the author at Ararat, Penna., where they were found growing in company.

Matricary Grape Fern.

All that has been said of the lance-leaved grape fern, may with equal truth be applied to the matricary grape fern (*Botrychium matricariaefolium*) with which it is almost invariably associated. Good botanists have often held that the two are but different forms of the same species. There are many intergrading forms, but each type remains fairly constant in a few particulars that seem to warrant us in considering them distinct. The most important is the difference in the time of fruiting. The present species fruits nearly a month earlier than *lanceolatum*, its spores often ripening by the middle of



PLATE II. THE MATRICARY GRAPE FERN *Botrychium matricariifolium*.

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June. It is also a taller, fleshier plant and rather the more common of the two.

The fronds are from four to twelve inches high and the blade, which is inclined to be ovate in outline, is situated a short distance below the fruiting spike. In small plants it may be only pinnatifid but in the larger species it is usually twice pinnate. In all, the final divisions are rather blunt. The fertile portion is usually taller than the sterile and twice or thrice pinnate. The sterile division differs from that of *lanceolatum* in being stalked after the manner of *B. obliquum* although the frond itself is more nearly like that of *B. Lunaria*.

In North America this species has the same range as *B. lanceolatum* and in Europe both species are found together. Recently botanists have questioned the identity of our species with the European one. If they are not the same, our plant would be known as *B. neglectum*.

In 1898 Mr. A. A. Eaton discovered in a New Hampshire sphagnum swamp a large number of peculiar *Botrychiums* which have since been described as a new species and named *Botrychium tenebrosum*. Many botanists incline to regard these specimens as forms of *B.*



MATRICARY GRAPE FERN.
Botrychium matricariaefolium.

matricariaefolium that have grown in situations unsuited to them. They would therefore seem more properly named *B. matricariaefolium tenebrosum*.

The smallest are only an inch high with tiny threadlike stems and minute fertile and sterile parts, while the larger sometimes reach a length of nine inches. They can hardly be called nine inches high, since in such specimens the stem is usually decumbent with two or three inches of the stipe under ground.



Botrychium matricariaefolium tenebrosum.

Like *B. simplex*, this form is extremely variable. In speaking of it at the Boston Meeting of the Fern Chapter in 1898, Mr. Eaton said: "The average height above ground is two inches and most commonly the sterile lamina is sessile or slightly stalked, less than one quarter of an inch long, the edge inflexed and top bent down just as it covered the fertile division. . . . In this state the sterile division bears one lobe or notch on each side and the apex is emarginate. Often it bears a sporangium and may even bear one or two on each lobe. From this there may be found a regular series up to the fully developed form, one and three fourths of an inch long, of which three fourths of an inch is petiole. There are in this two or three pairs of semi-lunate lobes, the lower of which are alternate and all decurrent. . . .

In small specimens the fertile division is overtopped by the sterile, but in the larger plants, the sterile division

reaches only to the base of the fertile. The latter varies in size from a short stalked division bearing one or two sporangia to a spike two inches in length." Mr. Eaton writes me that *tenebrosus* can always be distinguished from its allies by the notch in the tip of the sterile portion and by the spores which are nearly twice as large as those of *simplex*. The plant's small size and variable nature have caused it to be regarded as a variety of *B. simplex* also.

Tenebrosus grows on the borders of maple swamps. Where the earth is deeply covered with leaves, many specimens are never able to reach the light and air, but bear fruit, nevertheless. Thus far it has been reported from Vermont, New Hampshire, Massachusetts and New York. It is likely to be found elsewhere within the range of the other small *Botrychiums*. In some spots, two hundred and fifty specimens have been collected in an hour. Our illustration was made from specimens collected by Mr. Eaton.

The name of the genus is derived from a Greek word meaning a bunch of grapes and was given to this family in allusion to its clustered spore-cases. There are twenty-five or more species, widely scattered on the globe. In America, they are exceedingly variable and present some puzzling questions to the student. "Judging from size and external appearances alone," writes Prof. Underwood, "a regular gradation of forms might be arranged from the most diminutive undivided fronds of *B. simplex* to the largest of *B. Virginianum*."

THE BRACKEN.

" As a coming screen grows the bracken green ;
Up springeth it fair and free,
Where in many a fold, grotesque and old,
Twineth the hawthorne tree ;
A covert meet from the noontide heat,
Or should you steal anear,
You may chance to discern, neath the spreading fern,
The antlers of the deer.

" It boasteth a name of mystic fame,
For who findeth its magic seed
A witching and weirdly gift may claim,
To help him at his need :
Unseen, unknown he may pass alone
Who owneth the fern-seed's spell ;
Like the viewless blast, he sweepeth past,
And walks invisible !

" Have ye to learn how the eagle fern
Doth in its heart enshrine
An oak tree like that which the hunter Hearn
Haunted in days ' lang syne ? '
An oak tree small is repeated all
Complete in branch and root,
Like the tree whereunto King Charles did flee,
When pressed by hot pursuit.

" O eagle fern, when I thee discern
When thy withered leaf I meet,
In places the careless foot might spurn,
The crowded mart or street,
Thou takest me back to thy birthplace fair,
Where thou wavest in thy pride,
And the form of the hare and the deer's close lair
Doth mid thy stems abide."

—MARY ISABELLA TOMKINS.



THE BRACKEN.

IT is no easier to account for the likes and dislikes of ferns, than it is for those of more highly organized beings. Our ferns annually cast their spores by millions upon the wind to be sown broadcast, but the majority have seldom been able to get beyond their rather restricted limits, although the adjacent territory seems just as favourable to their growth. There are a few conspicuous exceptions to this rule, however, such as the cosmopolitan polypody, bladder fern and maidenhair spleenwort, but none of these are at home in so many places as our single representative of the brackens. There are nearly a hundred other species of this genus scattered about the world, but our plant has a wider range, both geographically and altitudinally than all the rest of its family together.

Wherever the bracken (*Pteris aquilina*) grows, it forms a conspicuous feature of the landscape. In British song and story it is constantly associated with the wildness and desolation of heath, moor and mountain side.

“The heath this night must be my bed
The bracken curtain for my head.”

sings Scott, while Cowper, drawing a picture of untamed nature, speaks of

“The common overgrown with fern, and rough
With prickly gorse.”

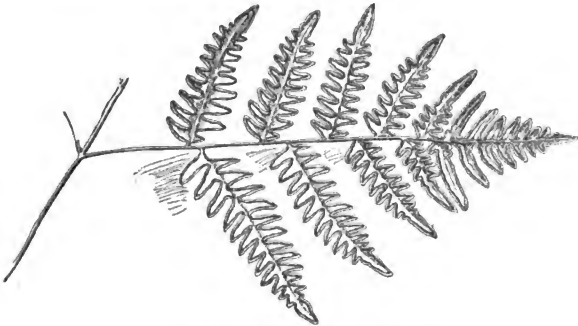
Less mention of this species is made by our own writers, though it is surely not for lack of occasion, as it fills a distinctive place in our scenery. It is perhaps the commonest American fern. Found both in the woodland and the open field, its favourite haunt is in neither, but in that half-way ground where man leaves off and Nature begins—the copse or thicket. Unlike most ferns, it seems to care little for shade. Given a scrubby hill-top or a neglected roadside half grown up to weeds and bushes and the bracken is sure to be there. It is the dominant fern of the half reclaimed lands. Indeed, it is said that the word brake, by which the fern is often known, is from an old Saxon word for fallow or clearing and that it was given to this fern because it is the first green thing to spring up in such places after they have been burned over. The word has since come to be applied, though less properly, to many of our larger ferns. The prevalent idea that brakes differ in some mysterious way from true ferns is without foundation in fact.

The most prominent characteristics of this fern are strength and coarseness, qualities well in keeping with the tangles in which it dwells. In eastern America it seldom grows more than three feet high with fronds that spread more than a yard across, but in more favourable localities it reaches a much larger size. Specimens thirteen feet long have been recorded from Ireland. Williamson notes that in the Alleghanies it covers large tracts and becomes the favourite haunt of the deer. Although the bracken is not particular as regards habitat its presence is supposed to indicate a thin and barren soil.

The rootstock is black, smooth and about as thick as ones little-finger. It is rather deep in the earth and

creeps for long distances. A good strong plant frequently has a rootstock measuring twenty feet or more in length. In endeavouring to avoid obstructions in the soil, it has been known to go to depths of fifteen feet. It branches freely and secondary rootstocks are frequently given off from the base of the stipes.

Although very abundant in northern countries, this species is quite sensitive to cold. A late spring frost frequently cuts down the young crosiers and the mature



BRACKEN. *Pteris aquilina*. Lower Pinna.

fronds early turn brown under the frosts of autumn although they commonly remain erect for most of the winter. The crosiers are quite characteristic and easily distinguished from all others. They are covered with a fine silvery-gray pubescence and the three divisions unrolling separately from the stiff stipes look not unlike the claws of some large bird. No doubt this accounts for the name of turkey foot fern, sometimes applied to it.

The fronds are produced all summer, rising from the rootstock at intervals of from six inches to six feet. They are triangular in outline and ternately divided; that is, the lowest pair of pinnæ are so much larger than the rest, that the frond appears as if made up of three nearly equal divisions. Counting these lowest divisions as pinnæ, the frond is three times pinnate below and passes by every gradation upward to the pinnate apex. In very large specimens the basal pinnules on the lower pinnæ are again lobed or parted, making this part of the frond nearly quadripinnate. The pinnules are narrow, two or three times longer than broad and set fairly close along the midrib.

The fruit is borne in a continuous narrow line on the margin of the pinnules and is covered by an indusium formed of its reflexed edges. There is said to be a second indusium, also, attached within the receptacle and spreading beneath the sporangia but this is not to be discerned in most specimens. When young the outer indusium forms a silvery-white edging on the underside of the pinnules, but as the spore-cases mature, they peep from under it, and turning a deep rich brown, cause the frond to look as if embroidered.

The bracken has many common names. Brake, bracken and eagle fern are the only ones in ordinary use in America. The last, as well as the specific name *aquilina*, is supposed to have been given to the plant from some eagle-like characteristic, but whether this is found in the claw-like crosiers, the broad fronds like an eagle's wings, or the spread-eagle which some fancy they see in a section of the stem, is not apparent. Erne fern, an old name for this species, is merely another variation for eagle fern, erne or herne, signifying eagle. The name

of umbrella fern refers to the spreading character of the fronds, and oak fern is another allusion to the appearance of a cross section of the stem. In Arkansas it is reported to be called upland fern. The word bracken forms part of many English surnames, and fern, farn and fearn, probably referring to the same species form part of as many more.

The superstitions that cluster about the bracken are very numerous. A cross section of the stem presents a curious arrangement of the vascular tissues which some have likened to the letter C. Accordingly the plant was supposed to be good to protect one from goblins and witches "because it bears the initial of Christ upon its root." The "canny Scot," on the other hand, sees in this section the mark of the devil's hoof. The appearance may also be fancied to resemble an oak tree and is frequently called "King Charles in the Oak." One ancient writer says, "If you cut the root of the bracken slantwise you will see the picture of an oak tree. The more perfect the representation, the more lucky you will be." By others the arrangement was held to form the initial of one's sweetheart.



The smoke from burning ferns also had its virtues. Parkinson says, "The fume of ferne being burned, driveth away serpents, gnats and other noisome creatures" and that "the sent of it is very gratefull to the braine." In the seventeenth century it was customary to burn the bracken when rain was needed. It is said there is still in existence a letter from an early English king, who, desirous of having fine weather during his visit to Staf-

fordshire, enjoined the High Sheriff to forbear burning the bracken.

The bracken is also the species originally reputed to bear the "mystic fern seed" and was called the female fern. According to the legend, fern seed could be obtained from this

"Wondrous one-night-seeding fern"

only on midsummer eve.

"But on St. John's mysterious night,
Sacred to many a wizard spell,
The time when first to human sight
Confest, the mystic fern seed fell :

.

I'll seek the shaggy, fern-clad hill
Where time has delved a dreary dell
Befitting best a hermit's cell ;
And watch 'mid murmurs muttering stern
The seed departing from the fern,
Ere watchful demons can convey
The wonder-working charm away,
And tempt the blows from arm unseen
Should thoughts unholy intervene."

At dusk the plant was supposed to put forth a small blue flower which soon gave place to a shining, fiery seed that ripened at midnight. If it fell from the stem of its own accord and was caught in a white napkin, it was supposed to confer upon its possessor the power to become invisible. Thus one of Shakespeare's characters is made to say,

"We have the receipt for fern-seed ;
We walk invisible."

For another way of obtaining fern seed, I quote an ancient authority. "Although that all they that have

written of herbes have affyrmed and holden that the brake hath nether sede nor frute, yet have I dyvers tymes proved the contrarrye. . . . I have foure yeres together, one after another upon the vigill of Saynte John the Baptiste . . . soughte for this sede of brakes upon the nyghte and indeed found it earlye in the mornynge before the daye brake. The sede was small, blacke and like unto poppye. . . . I gathered it after this manner.

I laid shetes and mollen leaves underneath the brakes which receyved the sede that was by shakyng and beatynge broughte out of the branches and leaves. . .

I went about this busyness, all figures, conjurings, saunter's charms, wychcraft, and sorceryes sett asyde, takyng wyth me two or three honest men to bere me com-

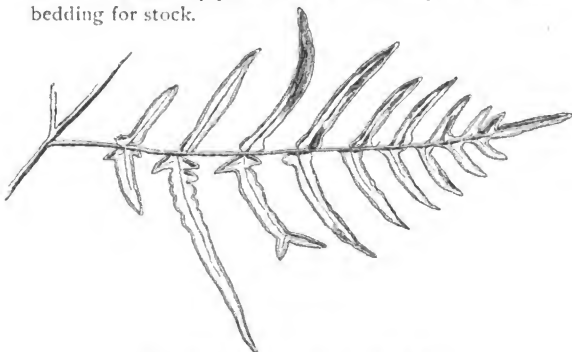


A FRUITING PINNA.

panye." If the charm failed to work, no doubt it was because all "sorceryes" were "sett asyde." Those who observed all the rules and waited for the small blue flower, no doubt came home disappointed. "Watching the fern," as this practice was called, had too much of black art in it to suit the Church, and in France a Synod condemned all who should gather ferns or fern seed on St. John's eve.

This is also one of the few species for which uses have been found. As a packing for fruit, fish and vegetables it has the reputation of keeping off mildew and decay. In

Europe, in times of scarcity, the roots have been ground and mixed with flour in making bread, and also brewed with the beer. The young crosiers may be cooked and eaten like asparagus. It is said that these are often offered for sale in the Japanese markets. The fresh plants contain much tannic and other acids and have been used in tanning light leathers. In Scotland they were formerly burned while green and the ashes made into balls and used instead of soap. The fronds make a brisk fire, and according to Withering, have been used for burning limestone. The ashes have also been used in making glass. Houses have been thatched with the fronds and in many parts of the world they are cut as a bedding for stock.



Pteris aquilina pseudocaudata. Lower Pinna.

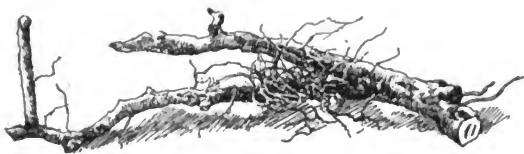
" In June and in August, as well doth appeare,
Is best to mowe brakes of all times of the yeere."

The bracken is seldom found in the fern garden, perhaps because it is so common in field and wood as to

almost justify its being considered a weed. The great spreading fronds, however, are not without their place in effective plantings. The species is one of the most difficult to transplant. The long running rootstock can rarely be taken up entire and those who can make it grow in new quarters regard it as an accomplishment. It is about as hard to start in a new place as it is to root it out when it has once obtained a hold. Those who intend to cultivate it should take up very small plants with plenty of earth early in spring. A few months will suffice to produce fine large fronds.

In dry sandy soil there is a variety of bracken known as *pseudocaudata* which differs from the type in its longer, narrower and more distant pinnules. It is found from Long Island to the Gulf of Mexico and Arizona, and is especially abundant in the pine barrens. The part of a frond shown is from a Long Island specimen collected by the author. It has frequently been confused with *P. caudata*, a species common in the Tropics and which also occurs in the southern part of the United States. In western America the common bracken gives way to the variety known as *lanuginosa* or *pubescens* which in addition to being much taller is densely woolly underneath.

The generic name, *Pteris*, is an ancient name for ferns in general, from a Greek word meaning a wing. Its application to this class of plants, containing as it does so many feathery forms, was exceedingly appropriate. The term is now restricted to the bracken family. Since our plant differs from other species of *Pteris* in occasionally possessing a second fugacious indusium it has been proposed to place it in a separate genus as *Pteridium* but this seems an over refinement.



THE BRACKEN ROOTSTOCK.

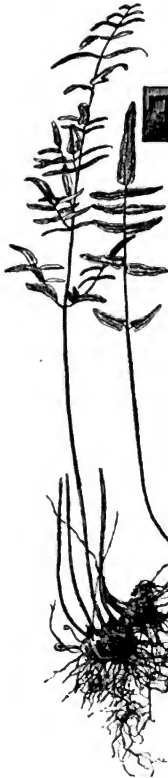
THE CLIFF BRAKES.

Far upward 'neath a shelving cliff
Where cool and deep the shadows fall,
The trembling fern its graceful fronds
Displays along the mossy wall.

The wildflowers shun these craggy heights—
Their haunts are in the vale below ;
But beauty ever clothes the rocks
Where Nature bids the ferns to grow.

Let others cull the flowers that bloom
By wood and field, by stream and hedge ;
For me there grows the dainty fern
That droops upon the stony ledge.

THE CLIFF BRAKES.



THE bracken is now considered to be the sole representative of its genus in northeastern America. Time was, however, when other species were classed with it, but owing to some slight differences in the manner of fruiting, these latter are now placed in the genus *Pellaea*. Superficially examined, the fruiting seems to be identical, but there is this difference: in *Pteris* the sporangia are borne on a continuous receptacle connecting the ends of the veins, on the margin of the pinnules; in *Pellaea* the sporangia are borne in dot-like masses at the ends of free veins, inside the margins. The indusia are similar and when the spore-cases of *Pellaea* are ripe, they frequently appear to form a continuous line, as in *Pteris*.

WINTER BRAKE. *Pellaea atropurpurea*.

The Winter Brake.

Those who dwell in other than limestone regions, have not a very good chance of finding the winter brake (*Pellaea atropurpurea*) at home. It is not entirely confined to calcareous rocks, but its occurrence upon other kinds is sufficiently rare to be noteworthy. Next to limestone, its preference is for sandstone, though even on limestone it is peculiar in its choice of situations and is common only here and there. It seems impatient of deep shade and not very particular as to moisture, in this showing one of the bracken's traits. It often thrives on dry cliffs in full sun.

Several things combine to make the winter brake a striking species. Especially is this so in regard to the colours it displays. The short creeping rootstock is covered with hairlike, bright brown scales, the stipes are dark, purplish brown and the fronds are bluish green, quite unlike the hue of ordinary species.

The blade is about as long as the stipe, the whole frond measuring from four to eighteen inches in length. In a general way the blade may be described as twice pinnate below, grading upward to the pinnate apex, but it is noted for its irregularity. Small fronds may be twice pinnate and larger ones simply pinnate; an entire pinna may stand opposite a pinnate one; one side of the secondary rachis may bear lobed pinnules and the other entire ones, while eared and forking pinnules are common. In sterile fronds the pinnules are oval or elliptical, but the fertile, which are somewhat taller, have broadly linear pinnules, due to the fact that part of each margin is reflexed to form the broad indusium. The infant fronds are undivided and nearly circular in outline, the



WINTER BRAKE. *Pellaea atropurpurea*.

next to appear are eared at base and in those that follow, the ears grow more distinct until they become separate pinnules. One fancies that all the pinnules of a large frond were successively cut off from the terminal one in this way.

The fronds remain green through the winter, the leathery texture of the blades enabling them to endure the cold, while the rootstock, which is frequently on the surface, is warmly wrapped in its protecting scales. When the fronds die, the pinnules drop from the rachis leaving the new growth surrounded by an unsightly tangle of dead stems.

From the colour of the blade this is often called the blue fern, while the colour of the stipe has suggested the specific name *atropurpurea* as well as the common one of purple-stemmed cliff brake.

The winter brake is found in suitable situations from British America to Georgia, Northern Mexico and California. Its natural habitat is rocky ledges, though it occasionally grows upon the masonry of bridges and other structures. Notwithstanding its predilection for limestone, it thrives in cultivation in any good soil if not kept too wet. A fruiting pinna of this species is shown in the Key to the Genera.

The Slender Cliff Brake.

The slender cliff brake (*Pellaea gracilis*) is even more closely associated with the limestone than its relative. There appears to be no record of its having been found on any but rocks of this character. In southern New York it grows on shales that contain but a small percentage of lime, which seems to be as far as it ever gets from

its natural place of growth. It is a frail and delicate species, little fitted to battle with wind and weather. It therefore seeks the shelter of shady dripping ledges and spreads its thin veiny fronds in the dim light, covering the shelving crags with graceful drapery.

The fertile fronds are taller than the sterile and more erect. Occasionally they may reach a length of nine inches although usually not more than half so long. The blade is lanceolate, and, in heavily fruited fronds, twice



TIP OF FERTILE FROND
ENLARGED.

pinnate with linear pinnules. When less fruitful the frond is usually simply pinnate with ovate pinnæ cut into oval or lanceolate segments, the terminal one longer and narrower than the rest. The sori are close to the margin and covered with a broad and conspicuous indusium usually extending entirely around the pinnule. The sterile fronds are generally simply pinnate with pinnatifid pinnæ and broad, obtuse segments which are entire or irregularly notched. The stipes are as long or longer than the blades and are straw-coloured. There

seems to be a complete gradation from wholly sterile fronds to those most heavily fruited.

This is one of our most delicate species and is able to live only in deep shade and moisture. It withers at the first sign of dryness, often disappearing by the first of August in situations subject to summer drouths. The greater part of its range appears to be north of the United



SLENDER CLIFF BRAKE. *Pellaea gracilis*.

States. The most southern stations are in Pennsylvania, Illinois, Iowa and Colorado, mostly in cool and elevated regions. It is quite remarkable that this thin-fronded plant which seems so little adapted to extremes of temperature should be found only in cold northern countries. It is plentiful on the sides of many ravines in Central New York especially in the habitats of the hart's tongue. It grows in Northern Asia, also.

The systematists have had much trouble in placing this species satisfactorily. It was long known to American botany as *Pteris gracilis*. Later it was called *Pellaea gracilis* and until recently was known by that name. Then it was changed to *P. Stelleri* and still later placed in another genus as *Cryptogramma Stelleri*. It is likely that the majority of botanists will continue to call it by the name we have given at the beginning of this description. The plant figured was collected near Binghamton, N. Y., at an altitude of about 900 feet.

The Dense Cliff Brake.

The dense cliff brake (*Pellaea densa*) properly belongs to the northwestern part of North America, being found from California and Colorado northward to Alaska, but it also strays as far east as Mt. Albert in Quebec. In this part of its range it is extremely rare. Only one other eastern local-



Pellaea densa. Fertile Frond.

ity is known for it, namely near Durham, Gray county, Ontario.

This species grows in the crevices of rocks in mountainous districts. The rootstock is rather small, and the wiry, purple-brown stipes, several times longer than the blades, are densely tufted. The blades are ovate-triangular in outline, pinnate at the summit and often four times pinnate at the base. So great is its tendency to fruit that sterile fronds are seldom seen. When they do occur, the pinnules are somewhat broader than those of the fertile fronds and are sharply serrate. In fruit the narrow pinnules are recurved over the sori in such a manner as to have the appearance of sharp-pointed, linear, half-open pods. They vary in length from a quarter to half an inch and are placed very closely together.

There are upwards of fifty species of *Pellaea*. The majority are inhabitants of warm regions. In California and the Southwest, there are about a dozen species, all found in rocky places. Some grow exposed to the full sun and during drouth curl up and become dry and brittle. When rain comes again the apparently dead fronds unfurl and take up vigorous life once more. The generic name is from the Greek and means dusky, in allusion to the stipes of most species.

THE WOODSIAS.

Across the mountain's crest of stone
Behold ! an emerald garland thrown
In many a fold, as soft and fair
As day-cloud idly lingering there ;
And now it ripples in the breeze
That scarcely stirs the forest trees ;
And now it shimmers in the light
In hues of brown or silvery white.
'Twould seem a vandal act to tread
Where such a dainty fabric's spread.
But drawing nearer, we discern
Naught save the banners of the fern ;
The Woodsia fern that scorns to dwell
By shaded cliff, in shadowy dell,
But on the gray ridge rooted fast,
Fears neither sun nor tempest's blast ;
And is, like pillared saint of old,
In summer's heat, in winter's cold,
Content above the world to brood
In silence and in solitude.



THE WOODSIAS.

THE fern collector who lives in a region abounding in shaded ledges of limestone may count himself fortunate, since it is in such places that the families of rock-loving ferns attain their best development. Rocks of any kind, however, unless perfectly dry and exposed to the full sunshine, have strong attractions for ferns and even the sunny cliffs are not always untenanted, so that all are worth searching. Explorations of this kind are among the most pleasant phases of botanizing. There is such an attractive element of chance in it. It is possible that we may find only common species, but it is also possible that the next turn in the cliffs or a climb to a higher ledge may bring to our hand some rare and graceful denizen of the rocks for which we have long been looking.

The Rusty Woodsia.

An interesting little member of one of these rock-loving families is the rusty woodsia (*Woodsia Ilvensis*). In its chosen haunts it has few companions and no com-

petitors, for it elects to dwell in places where most others cannot exist. It delights in the very crests of exposed precipices, often growing in full sun. In the region about Little Falls, N. J., it is an abundant and characteristic species, growing in dense tufts on the rugged trap-rock hillocks. A climb up the loose and crumbling ledges is not without its adventures, but one feels fully

repaid for the scramble by the first sight of the woolly little plants at the top.

It is a decidedly social little species and is usually found with rootstocks and fronds so matted and intertwined that it is difficult to decide how much belongs to any one plant. The rootstocks nestle in the shallow crevices and produce fronds all summer. The young crosiers are covered with a dense coat of silvery-white, hairlike scales and present an attractive picture when unfolding amidst the browns and dark greens of mature fronds. Doubtless this hairy covering is of service in preventing too great evaporation during the heat of summer. On old fronds the upper surface is usually little if at all hairy, but underneath, they are so woolly that the fruit-dots are almost concealed. At maturity



RUSTY WOODSIA.

Woodsia Ilvensis.

this wool turns to a rusty brown and gives occasion for the common name.

The stipes are comparatively short and remarkable for possessing an obscure joint an inch or more above the rootstock, at which point they separate when the fronds die, leaving the bases as a sort of stubble still attached to the rootstock. This single characteristic may be depended upon to distinguish the species from



ROOTSTOCK.

Cheilanthes vestita, a fern which otherwise very much resembles it, even as to habitat. The fronds seldom attain a length of more than eight inches and the average length is several inches less. They are rather stiff, long-lanceolate in outline and pinnate with numerous pinnæ that are themselves cut nearly to the midribs into short, rounded, close-set lobes. Occasionally the lobes nearest the rachis are distinct.

The sori are borne on the backs of the veins on the underside of ordinary fronds and near the margins, but owing to the hair-like scales by which they are surrounded are seldom very noticeable. They are round in shape and have the indusium fixed underneath the sorus. The indusium, however, is scarcely entitled to the name except by courtesy. It consists simply of a few slender hairs which curve over the sporangia in youth "as if attempting to protect what they cannot conceal."

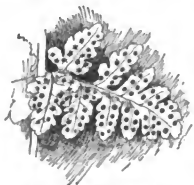
Woodsia Ilvensis is a northern species, being found in Greenland and throughout British America as well as in northern Europe and Asia. In the United States it ranges to North Carolina and Kentucky and while it is by no means a common species, it is abundant in certain localities. It is found upon various rocks but seems to have a preference for those of igneous origin. In Canada, it is reported to lose its fronds at the approach of winter,

but further south it appears to be half evergreen. Among its common names are oblong Woodsia, hairy Woodsia and hair fern. A living plant of this species is illustrated in the initial design for this chapter.

The Obtuse Woodsia.

The obtuse Woodsia (*Woodsia obtusa*) is the only common member of the genus in eastern North America. It is to be looked for on shaded ledges and in the loose talus at the base of cliffs and seldom occurs in the exposed situations affected by *Ilvensis*. When it does find itself in the sun, the change is apparent at once since it takes on a yellow-green colour and becomes thicker and more erect.

In length the blades vary from six to fifteen inches. They are oblong ovate in outline and once pinnate with triangular-ovate, rather distant pinnæ. The pinnæ are pinnatifid, or pinnate near the base, with oblong, slightly lobed pinnules and segments. Both pinnules and pinnæ are quite blunt. This feature is one of the points by



FRUITING PINNA.

which it may be distinguished superficially from *Cystopteris fragilis* with which it is very often confused. The stipes are about a third as long as the blades, light in colour and bear scattered brownish scales. Similar scales are found on the rachis. The blades are nearly always minutely

glandular-hairy and the rootstock is short.

The sori are round and borne near the edge of the segments on ordinary fronds. Under a lens they are among the most beautiful of their kind. As in all the



OBTUSE WOODSIA. *Woodsia obtusa*.

Woodsias, the indusium is fixed to the frond underneath the sorus. In the beginning, it surrounds the sporangia, but early splits into several segments which spread out in star shape when the sorus considerably resembles a small green flower, the indusium answering to the corolla and the sporangia to the essential organs.

The range of the obtuse *Woodsia* is almost wholly in the United States. One station in Nova Scotia is all that is known beyond our limits in the East. Southward it extends to Georgia, the Indian Territory and Arizona. It is also reported from British Columbia and Alaska. It may occur on any shaded ledge but it is not always to be found in what appear to be suitable situations. It is usually less common than its counterpart, *Cystopteris fragilis*. In the southern part of its range, the fronds are evergreen but their texture would indicate that this condition does not prevail northward. A small and more glandular form has been described as the variety *glandulosa*. The common form in fruit is illustrated in the Key to the Genera.

In the West the obtuse *Woodsia* is represented by two other species which are occasionally found as far east as northern Michigan. The first of these, *Woodsia Oregana*, is chiefly distinguished by its narrower blade covered beneath with flattened hairs and stalked glands, its oblong-ovate, toothed pinnæ and the much narrower segments of the indusium. The second species, *Woodsia scopulina*, has shorter, nearly smooth fronds, with triangular-ovate pinnæ the lowest of which are noticeably shortened. The indusium, which consists merely of a few hair-like divisions, is difficult to see in ordinary specimens. In appearance and habitat, both species are much like the obtuse *Woodsia* and at various times have been described as varieties of it.

The Alpine Woodsia.

The rare little alpine Woodsia (*Woodsia hyperborea*) is an inhabitant of the colder parts of both Europe and America. It is usually supposed that it was first discovered in the United States by C. G. Pringle at Willoughby Mountain in Vermont, but it was collected in the Adirondack Mountains in New York by Prof. C. H. Peck nearly ten years earlier. At that time the specimens were referred to *W. glabella* and it remained for B. D. Gilbert to discover their identity. His announcement of this, however, was somewhat later than Eaton's announcement of Pringle's discovery. It has since been found at a few other stations along our northern border in Maine, Vermont and New York. In these, it is never found except at considerable elevations and is always so rare as to be considered a great prize by the collector.



ALPINE WOODSIA.
Woodsia hyperborea.

The largest fronds are scarcely six inches long and half an inch broad and grow in little tufts from a short rootstock. They are linear-lanceolate, pinnate with ovate or ovate-oblong pinnæ cut nearly to the midrib into rounded lobes. The blades are smooth or slightly chaffy and the indusium consists of a few hair-like processes that radiate from beneath the





OBTUSE WOODSIA. *Woodsia obtusa*.

round sori as in *W. Ilvensis*. The stipe is brown and jointed near the rootstock.

Many botanists have considered this species but a smooth form of *W. Ilvensis*. Except for its size and lack of scales there is very little to distinguish it from its larger relative. Its habitat is reported to be on moist rocks. North of the United States, it is found sparingly from Ontario to Labrador and Alaska. The plant was for a long time known among botanists as *Woodsia alpina*.

The Smooth Woodsia.

The smooth Woodsia (*Woodsia glabella*) is nearly allied to the alpine Woodsia and is found in the same places. It may be distinguished by its shorter fronds, fan-shaped, often three-parted, pinnules with toothed margins and by the straw-coloured stipes. Like *W. hyperborea* it is also found in Europe and although probably more plentiful than its ally, is nowhere common. Mr. W. W. Eggleston, who has had abundant opportunities for studying these rare ferns in the field, writes of them in the *Fern Bulletin* as follows: "Many of our best botanists collect both, thinking they have nothing but this species [*hyperborea* (*alpina*)]. *Alpina*, however, has a black or brownish rachis with scattered palaceous hairs, while that of *glabella* is entirely smooth and green. *Alpina*, also, has a larger, coarser appearance in the field. . . . We are more often deceived, now, by smooth forms of *Ilvensis* than by *glabella*; in fact, some smooth forms of the former require an expert to separate." FERTILE FROND.



The smooth *Woodsia* is found from New Hampshire, Vermont and Northern New York to the far North and Northwest. Our illustrations of this species and of *W. hyperborea* were made from specimens collected in Vermont by Mr. Eggleston.

The genus *Woodsia* was named in honour of Joseph Woods, an English botanist. It contains a dozen or more species all confined to the colder parts of the world.



SMOOTH WOODSIA. *Woodsia glabella*.

THE CHRISTMAS AND HOLLY FERNS.

When frost has clad the dripping cliffs
With fluted columns, crystal clear,
And million-flaked the feathery snow
Has shrouded close the dying year ;
Beside the rock, where'er we turn,
Behold, there waves the Christmas fern.

No shivering frond that shuns the blast
Sways on its slender chaffy stem ;
Full-veined and lusty green it stands,
Of all the wintry woods the gem.
Our spirits rise when we discern
The pennons of the Christmas fern.

With holly and the running pine
Then let its fronds in wreaths appear,
'Tis summer's fairest tribute given,
To grace our merry Yuletide cheer.
Ah, who can fear the winter stern
While still there grows the Christmas fern.

THE CHRISTMAS AND HOLLY FERNS.



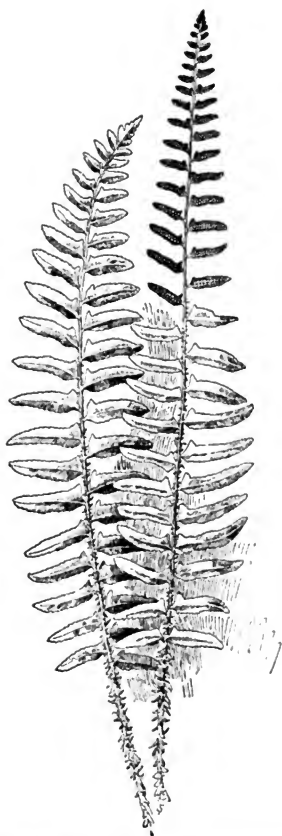
HOWEVER much we may admire the summer species, we can scarcely fail to have a higher regard for those sturdy ferns that remain through cold and snow to make the woodlands and thickets less dreary. For the most part they are among our coarsest species—delicate fronds have little chance against the frost—and for this reason are likely to be overlooked or neglected in a milder season. But when in dark and stormy weather the green fronds wave us a welcome from icy ledge or snowy thicket, the day seems suddenly to brighten.

Foremost among our winter species must be placed the members of the *Polystichum* family. These are often classed with the wood ferns in the genus *Aspidium* or *Dryopteris*. The wood ferns indeed are their nearest relatives, but there is this important difference between them: in the *Polystichums*, the sori are round and covered with a circular indusium which is fixed to the frond by its depressed centre; while in the wood ferns, the indusium is usually reniform and attached to the frond by the sinus. Like the wood ferns these species are sometimes called shield ferns and buckler ferns.

The Christmas Fern.

To the hunter, the trapper and the Rambler in the winter woods, the Christmas fern (*Polystichum acrostichoides*) is a familiar species. In summer it is not especially noticeable, but in the snowbound season, the cheerful, fresh-looking fronds are sure to attract the eye. It is a most abundant species and suitable localities within its range where it cannot be found are exceedingly rare.

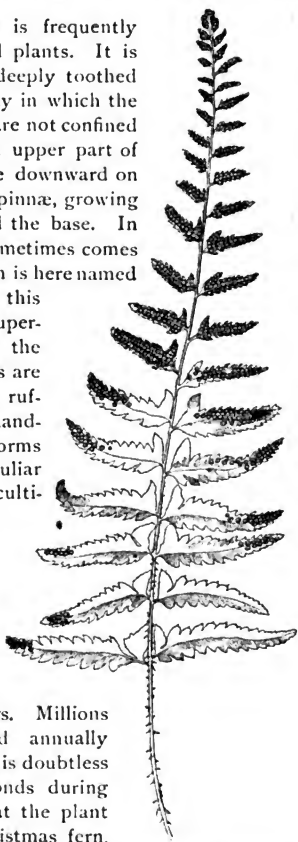
All the Christmas fern's fronds are produced early in spring. They rise in circular clumps from a stout root-stock and when uncoiling are thickly covered with silky-white scales that make them conspicuous objects in the vernal woods. As the fronds mature, the scales turn brown and many remain upon rachis and stipe, especially the latter, through the season. The fronds occasionally reach a height of three feet, and are thick, narrowly lanceolate, acute and once pinnate. The numerous narrow pinnules have finely serrate margins and are arranged alternately on the rachis. Each has a triangular ear on the upper side at base. The fertile fronds are taller than the sterile and differ in having the upper third or half suddenly decreased in size, this part bearing the sporangia. The sori are arranged on the under surface in two or more rows lengthwise of the pinnules with two other short rows on the earlike projections. They are partly formed before the fronds unfurl and ripen early in the year, being among the first of our species in this respect. The sporangia early push out from beneath the peltate indusia and make the fruiting pinnules look like little assemblages of tiny brown ant-hills. One of these pinnules is shown in the Key to the Genera.



CHRISTMAS FERN. *Polystichum acrostichoides*.
Fertile and Sterile Fronds.

The variety *incisum* is frequently found with the typical plants. It is distinguished by the deeply toothed pinnules and by the way in which the sori are borne. These are not confined entirely to the narrowed upper part of the frond, but continue downward on the tips of the other pinnae, growing fewer in number toward the base. In rich shady woods, one sometimes comes upon another form which is here named variety *crispum*. In this there seems to be a superabundance of tissue in the fronds and the pinnules are beautifully crisped and ruffled. It is by far the handsomest of the common forms and does not lose its peculiar characteristics under cultivation. Fronds are occasionally found with the pinnules again pinnate.

Owing to the enduring nature of the fronds, they have been extensively used in floral decorations in recent years. Millions of them are now used annually in all our large cities. It is doubtless from this use of its fronds during the winter holidays that the plant derives its name of Christmas fern.



Polystichum acrostichoides incisum.



HOLLY FERN.
Polystichum lonchitis.

The fronds of an allied species are similarly used for decorations in the West.

The Christmas fern is found from southern Canada to Florida, Mississippi, Arkansas and Wisconsin. Its favourite haunt is probably a rocky "side hill," sloping away from the south and covered with a variety of deciduous trees, but it does not disdain the evergreen woods or even the scrubby roadsides. Even after the sheltering copse is cut off, it manages to exist for some time in the sunlight though with stunted and dull coloured fronds. In the West, our species is represented by *P. munitum* which has the same eared pinnules and looks much like it but lacks the narrowed tips in the fertile fronds. Our plant is frequent in out-door cultivation, its hardiness making it one of the most satisfactory species for this purpose.

The Holly Fern.

It is quite in keeping with our ideas of such matters that the holly fern (*Polystichum lonchitis*) should be an evergreen and nearest of kin to the



PLATE III. THE CHRISTMAS FERN. *Polystichum acrostichoides*.

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Christmas fern. Half the appropriateness of the name would be lost if the plant dropped its fronds at the beginning of winter. Its name, however, was not given because of its presence during the holiday season, but because the pinnules are set with bristle-tipped teeth which gives them a considerable resemblance to holly leaves. That it loves the cold, is shown by its range which extends over the northern parts of both Hemispheres. In America, its southern limits are nearly identical with the northern limits of the Christmas fern, as if Nature had assured herself that there should be no rivalry, by keeping separate two species so nearly alike.

The holly fern is rather smaller than the Christmas fern but in many ways suggests the relationship. Like it, the fronds are narrow, lanceolate, once pinnate with eared pinnules, and grow in circular clumps. They differ, however, in the shorter, broader and scythe-shaped pinnules, in the basal ones being reduced to small green triangles and in producing sori on the backs of ordinary fronds. The pinnules are often so closely set as to overlap and the margins are sharply toothed. The stipes are also shorter. The sori are confined to the upper part of the frond and are arranged on the pinnules in two rows midway between the margin and the midrib, and also on the eared bases.

This species is found in most of British America, being rarest in the Southeast. It does not occur in the Eastern United States but is found sparingly in Wisconsin, and in the West extends as far south as Utah and California. It is a lover of the rocks, its favourite dwelling place being the talus of broken stone at the base of shaded cliffs.

*Polystichum Braunii.*

Braun's Holly Fern.

The last of this trio of *Polystichums*—*P. Braunii*—is, like the holly fern, an inhabitant of the more northern parts of our continent. It is a singularly decorative and beautiful species and belongs to a type that is found the world over. The typical species is called *Polystichum aculeatum* and our plant was long thought to be a variety of it. It is now considered by most botanists to be a distinct species.

The rootstock is short and thick and the fronds usually reach a height of two feet or more. They are lanceolate in outline on short stipes and twice pinnate. The pinnae are linear-oblong, usually acute, and broadest at base, their ovate or oblong divisions appearing like small duplications of the holly fern's pinnales, even to the ear on the upper side at base. Both stipe and rachis are densely clothed with short hair-like growths as well as with the ovate, brown scales common to its allies. The sori are on the backs of ordinary fronds and not very conspicuous. The fronds remain green through the winter but the stipes are unable to hold them erect. On account of the resemblance of the pin-

nules, the holly fern was once believed to be an immature form of this species or of the closely allied, *P. aculeatum*.

According to Dodge's "Ferns and Fern Allies of New England," this species is common along the mountain brooks of northern New England. In Canada it is found sparingly in the Provinces of New Brunswick, Nova Scotia and Quebec. Southward it ranges to the mountains of Pennsylvania, having been collected at several localities in that State. It is also found in Michigan. In the West it is replaced by the true *P. aculeatum* as well as by the varieties *Californicum* and *angulare*.

The genus *Polystichum* as now defined contains about thirty species, pretty generally distributed throughout the world. The name is derived from two Greek words signifying many rows. It is difficult to understand its application here unless it refers to the rows of sporangia.



CROSIERS.

THE MARSH FERN TRIBE.

“ As gracefully as ladies fair
 Bend o'er their mirror's sheen,
So o'er the turbid water's breast,
 Thy plumes are waving green ;
As sweet and fair as ladies bright,
Thy plumes gleam in the morning light.”

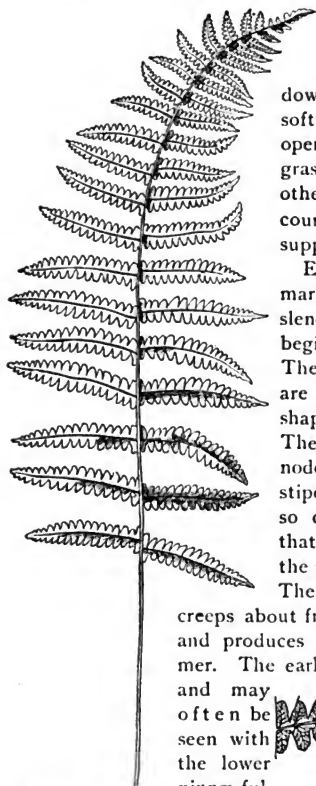
THE MARSH FERN TRIBE.



IN Eastern America, two families of ferns divide nearly half our species between them. One of these is known as the genus *Aspidium* or *Dryopteris*, the other as *Asplenium*. As the genus *Aspidium* has been understood in America, it has included a diversity of forms, some of which have but recently been removed to the genus *Polystichum*. Those that remain fall very naturally into two divisions as regards form and habitat, and to the smaller of these, of which the marsh fern may be taken as the type, we have for convenience given the title of the marsh fern tribe. The species have a strong family resemblance—almost too strong, the young student may be inclined to say when he comes to study them—but a little study will soon fix the characters of each in the mind, after which they may be distinguished at a glance.

The Marsh Fern.

Any one who has visited a bushy swamp in the north-eastern States, where alders, button-bushes and cat-tails flourish, has doubtless seen the marsh fern (*Aspidium Thelypteris*). It is one of our commonest species, and although, as its name indicates, the marsh is its favourite



MARSH FERN.
Aspidium Thelypteris.

dwelling place, it is also found in the wet woodlands, along streams and in damp meadows. It avoids actual water but soft watery mud is its delight. In open places it grows as thickly as grass, often to the exclusion of other vegetation, and seems to court the sun if it can obtain a supply of moisture.

Early in spring, before other marsh plants have come up, the slender crosiers of the marsh fern begin to push above the black soil. They are not flattened laterally as are the crosiers of most ferns but shaped like little green spheres. These attractive looking objects nodding at the tops of the long stipes in the swampy wastes, are so characteristic of the species that one may frequently identify the plant from the crosiers alone. The slender, cord-like rootstock creeps about freely just beneath the surface and produces fronds throughout the summer. The early ones develop very quickly and may often be seen with the lower pinnæ fully spread while the upper are still coiled.



VENATION.



THE MARSH FERN.
"Along streams and in damp meadows,"

The first fronds are always sterile. They are thin, lanceolate, broad at base and once pinnate, with the pinnæ set at right angles to the rachis. The latter are oblong-linear, pointed and cut nearly to the midrib into many close, short, rather rounded lobes. Bipinnate fronds with toothed or pinnatifid pinnules also occur.



SORI.

It is not until about the middle of July or later that the fertile fronds are produced. They are like the sterile in form, except that the pinnules are somewhat narrower and appear as if pointed, owing to the margins being reflexed over the fruit when it is young. The sori are borne in a double row on each pinnule and are well on the way toward maturity when the frond unfurls. The indusium is kidney-shaped and soon withers. The sporangia then spread out and often completely cover the under surface of the pinnule. Fronds midway between fertile and sterile also occur. In these the pinnules are flat and the less abundant sori are confined to the upper part of the frond and the tips of the lower pinnæ.

In deep shade, the marsh fern grows tall and slender but fruits sparingly; in sun, the fruit is abundant but the fronds lose much of their beauty, becoming thicker, yellowish and with pinnæ strangely contorted. Both sorts of fronds are borne on long stipes, in some cases twice as long as the blades. The plant is commonly not fragrant, though specimens have been reported that emitted an agreeable odour when drying. After the first sharp frost the fronds in exposed places wither, but in sheltered situations they remain green for a month or more longer.

This species is frequently known as the lady fern—in deed, its specific name signifies as much—but the real lady

fern belongs to another family. In the Isle of Wight, according to Britten, it is called ground fern, while another English writer alludes to it as the creeping water fern. In some parts of America it is called the beaver meadow fern probably from its abundance in the wet



THE SNUFF-BOX.

doubt be thought particularly appropriate by all who examine fully matured fertile fronds. The pinnules curl over the abundant sporangia in such a way as to appear very much like tiny half-open snuff boxes. Perhaps quill fern is also in allusion to the revolute pinnules.

The marsh fern is found from Canada to North Carolina, the Indian territory and Kansas and occurs also in Europe and Asia. It thrives well in the fern garden but can scarcely be said to be a beautiful species and is therefore little cultivated except upon the borders of small lakes and ponds.

The New York Fern.

Just as the marsh fern loves wet situations, the New York fern (*Aspidium Noveboracense*) loves dry ones. It is not meant that either is strictly confined to its favourite domain, but that their habitats seldom overlap to any great extent. In dry, shady woodlands, this is an abundant—possibly the most abundant—species. It particularly loves the shade of oak, birch, maple and beech but avoids direct sunlight and seldom remains long after the sheltering trees are removed.



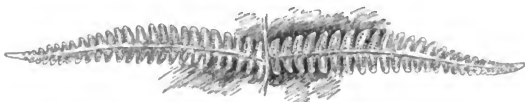
NEW YORK FERN. *Aspidium Noveboracense*.

The slender crosiers of this species resemble those of the marsh fern, with blades rolled into similar green balls, but the stipes are much shorter. The mature fronds are very thin and delicate, of a light yellow-green colour, and are produced in tufts along a slender creeping rootstock. In shape they are broadly lanceolate, pinnate, and taper from about the middle to the acuminate apex. Below, the pinnæ grow farther and farther apart, and are gradually reduced in size until the lowest are mere green ears. The pinnæ are lanceolate, acute and pinnatifid, with numerous, narrow, round-ended pinnules.

The fronds are often finely hairy underneath and strewn with minute glands. When the foliage is bruised these glands give out a pleasing odour which has been called lemon-like, by one writer and vanilla-like, by others. The fact is, however, that it can hardly be likened to the odour of any other substance. It is the same ferny scent common to numerous species but in this one sweet and strong. One of its allies, *Aspidium oreopteris*, is called sweet-scented fern in England. It is described as having the under surface sprinkled with shining, yellowish, resinous globules, and even the crosiers are fragrant. One of its admirers writes of it, "Few things in nature are more beautiful than a great number of these plants



NEW YORK FERN.
Aspidium Novboracense.



FRUITING PINNÆ.

before they are unfolded. The grass seems strewn with silver balls and as you reluctantly tread on them and brush by them, the scent is delicious."

Prof. Peck has described a variety *fragrans* of the New York fern which is principally distinguished by the odour, and later, Eaton made a variety *suaveolens* of which he says, "Fronds narrower, slightly more rigid, very sweet scented in drying, the under surface copiously sprinkled with minute glands." This is apparently only a form which, exposed to the sun, has made some slight changes to adapt itself to the new conditions, as other ferns are known to do.

The fertile fronds are produced a little later than the sterile and scarcely differ from them except that heavily fruiting fronds are slightly taller and narrower. As in all of the *Aspidiums*, the sori are round and covered with a kidney-shaped indusium. In this species the indusium is dotted with little glands and the sori are rather small and borne in a double row on each pinnule near the margin.

Young collectors frequently mistake this for the marsh fern, and indeed the early botanists were themselves in some doubt about it. Several gave it the specific name of *thelypteroides* because of its resemblance to *Thelypteris*, and others called it the variety *Novboracense* of the latter. The two, however, are very distinct. If it is remembered that in *Novboracense* the pinnæ are always much decreased toward the base of the frond, it will not be

easy to confuse it with its ally. In fact, the single characteristic of the reduced basal pinnæ serves to distinguish this species from all the other members of its genus in eastern America.

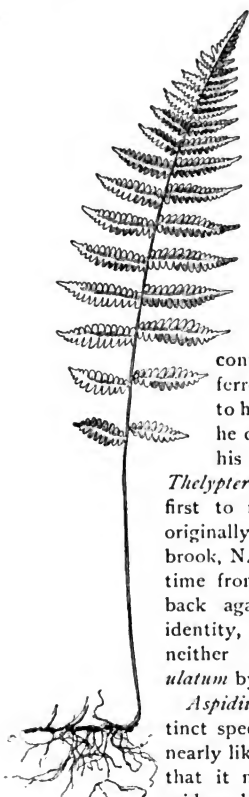


VENATION.

The New York fern is found from Newfoundland to North Carolina, Arkansas and Minnesota. It seldom reaches a greater height than two feet and is one of our most delicate woodland species. In the vicinity of New York City it is very abundant and it grows luxuriantly on the wooded crests of the Palisades in New Jersey. It is reported to occur also in the mountains of Southern Asia. In California there is a species (*Aspidium Nevadense*) which very closely resembles the New York fern, even to the reduced pinnules at the base of the frond. It has, however, a stout rootstock and the fronds are produced in circular crowns. Our species is easily cultivated. In some books it is called bear's-paw, a name without apparent meaning.

Aspidium Simulatum.

Counting from the time of christening, *Aspidium simulatum* is our youngest fern. It has been known to science for barely half a dozen years. When its discovery was announced and the features in which it differs from other ferns pointed out, those who had trampled it under foot for years, supposing it to be merely a form of *Notholaena* or *Thelypteris*, were quite astonished, and the wonder grew when it was subsequently found to be

*Aspidium simulatum.*

fairly plentiful over a wide range of territory. When one becomes acquainted with its appearance it is very easily distinguished from its congeners, but its superficial resemblance to the marsh and New York ferns is close enough to make trouble for the novice.

When this species was first collected, is perhaps not known. There is a note in Eaton's "Ferns of North America" regarding a form of *Thelypteris* "with most of the veins simple and the lower pinnae a little contracted" which is doubtless to be referred to this species, and Lawson seems to have had the same thing in mind when he described in the *Canadian Naturalist* his variety *intermedium* of *Aspidium Thelypteris*. Mr. Raynal Dodge, however, was first to notice its specific differences. He originally collected it about 1880 near Seabrook, N. H., and after referring it for some time from *Thelypteris* to *Noveboracense* and back again without being satisfied of its identity, came to the conclusion that it was neither. It was subsequently named *simulatum* by Mr. Geo. E. Davenport.

Aspidium simulatum is certainly a very distinct species, but in habit and habitat it is so nearly like its allies as to suggest the thought that it may be a hybrid. It seems about midway between the two in everything, even as

to the place in which it grows ; for while *Thelypteris* loves the sunny swamps and *Noveboracense*, dryish shades, the present species demands the moisture of the one and the shade of the other and is to be found in deep wet woodlands.

The rootstock, as might be inferred, creeps near the surface of the soil and sends up bipinnatifid fronds which are like those of *Thelypteris* in general appearance but like those of *Noveboracense* in colour, texture and the graceful curve of the blades. In technical language they may be described as lanceolate, acuminate, pinnate with numerous sessile, lanceolate, long-pointed, pinnatifid pinnæ and narrow obtuse segments.

In the vicinity of New York, the fertile fronds appear



FRUITING PINNA.

in July. They are slightly taller and more erect than the sterile and bear the medium-sized sori in a double row on the pinnules. The indusia are thin and rather more conspicuous than those of its nearest relatives. Although the frond may be heavily fruited, the pinnules appear never to become revolute as in *Thelypteris*.

When seen growing in masses this fern seems almost identical with *Noveboracense* but single fronds show a very decided difference. While the lower pinnæ may be slightly smaller than those in the middle of the frond, they are never so greatly reduced as in *Noveboracense*. The stipes are also much longer. The marks by which it may be distinguished from *Thelypteris* are the flat fertile

pinnules, lanceolate pinnæ and simple veins. In *Thelypteris* the veins normally fork once.

Aspidium simulatum is at present known to grow in most of the New England States, New York, Pennsylvania and Maryland. Its partiality to spruce and tamarack swamps is most pronounced. In the two localities known for the fern in New York State, it grows in dark cedar swamps in company with *Woodwardia angustifolia* and an occasional marsh fern. It is a singular fact that it thrives best in spots too shady for *Thelypteris* to be fruitful, and in moisture too great for *Noxboracense* to be common. It is the opinion of many botanists that this species is nearly as widely distributed as the ferns it mimics but is not reported because confused with the others. There is a tendency in some sections to call this the Massachusetts shield fern. But since the fern is not confined to that State, and is common in localities far removed from New England, such a name is both unfortunate and misleading. Many suppose that this species was named *simulatum* because of its resemblance to *Noxboracense* and *Thelypteris*. While this thought may



VENATION.

have occurred to its describer, he writes that it was so named because it simulates a narrow woodland form of the lady fern (*Athyrium Filix-femina*). Even the young collector, however, ought to be able to distinguish it from the latter. Our illustrations are from specimens collected by the author near Babylon, Long Island.

The generic name, *Aspidium* is from the Greek and

means a little shield, in allusion to the shape of the indusium. Many of the common names given to members of the genus are also derived from this shape. *Dryopteris*, sometimes used instead of *Aspidium*, is also from the Greek and literally means oak-fern. There are upwards of one hundred and fifty species distributed throughout the world. It is probable that the generic name *Nephrodium* will ultimately be used for these species in America. It is the name commonly used abroad.

THE WOOD FERNS.

"What means this persistent vitality? Why were these spared when the brakes and osmundas were stricken down? They stay as if to keep up the spirits of the cold-blooded frogs which have not yet gone into the mud, that the summer may die with decent and graceful moderation. Is not the water of the spring improved by their presence? They fall back and droop, here and there like the plumes of departing summer, of the departing year. Even in them I feel an argument for immortality."—THOREAU.



THE WOOD FERNS.

DOUTBLESS the majority of our ferns grow in forests, or at least in shady places, and so might without impropriety be called wood ferns, but the members of the genus *Aspidium* are so noticeably abundant in all forested areas that the name seems by right to belong to them. In the matter of names, however, this genus has been rather unfairly treated so far as a permanent name is concerned. As to the number of its names, nothing can be complained of. In the vernacular, the species are known as shield-ferns, wood-ferns, boss-ferns and buckler-ferns and the scientists are divided as to whether the genus shall be known as *Aspidium*, *Dryopteris*, *Nephrodium* or *Lastrea*. In the Old World, the species are oftenest called *Lastrea* or *Nephrodium*; in American books they will usually be found in the genus *Aspidium*. It is but recently that the proposal to substitute the name *Dryopteris* has been made. This latter may perhaps be the oldest name, and therefore, according to the much cited rule of priority, the proper one for the genus, but it has thus far failed of acceptance by most botanists.

Whatever confusion exists in regard to the names, does not extend to the plants themselves. They may at once be distinguished from other ferns by bearing their sporangia in roundish sori covered with a kidney-shaped indusium that is attached to the frond by the sinus.

The Marginal Shield Fern.



MARGINAL SHIELD FERN. *Aspidium marginale*.

In rocky woodlands, especially in hilly country, the marginal shield fern (*Aspidium marginale*) is a common and well-known species. It delights to nestle among the buttressed roots of large trees or in crevices between the rocks where a light soil has accumulated, putting up its graceful circles of fronds wherever it can obtain a foothold.

This species has the heaviest rootstock of any of the wood ferns. It is rather short, although occasionally rising a few inches above the earth and is densely clothed at the crown with long chaffy brown scales. The half dozen or more fronds are produced early in spring. They are thick, almost leathery in texture and of a peculiar dark, blue-green colour, lighter beneath. They are two or three feet long with lanceolate twice pinnate blades, at least below. The pinnæ are lanceolate, broadest at base, with numerous narrow, slightly falcate pinnules which, especially in the lower part of large fronds, may be again lobed or pinnatifid. The stipes are rather short and densely chaffy.



PLATE IV THE MARGINAL SHIELD FERN *Aspidium marginale*.

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The sporangia are borne on fronds similar to the sterile ones and appear almost



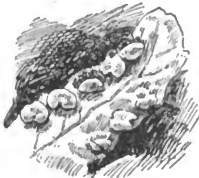
SORI, ENLARGED.

as soon as the fronds unroll in spring. The conspicuous indusia are convex, white or lead colour when young, and owing to their thickness, do not wither so soon as



FRUITING PINNÆ.

the indusia of most ferns. The sori are found on the margins of the pinnules and so close to the edge as to often appear to project beyond it. There is no crowding of the sori. Each is separated from its neighbour



SORI.

by an appreciable interval and if one happens to be missing, its place is not encroached upon by the others. This manner of fruiting is so characteristic that it alone serves to distinguish this species.

It is to be regretted that the strictly American ferns have so little folk-lore connected with them. Our country was apparently settled at too late a period of man's mental development for the ferns to be viewed with the same degree of wonder and speculation that Old World species inspired in earlier generations. Most of our folk-lore has been imported and such of our species as do not occur on the other side of the world usually have no

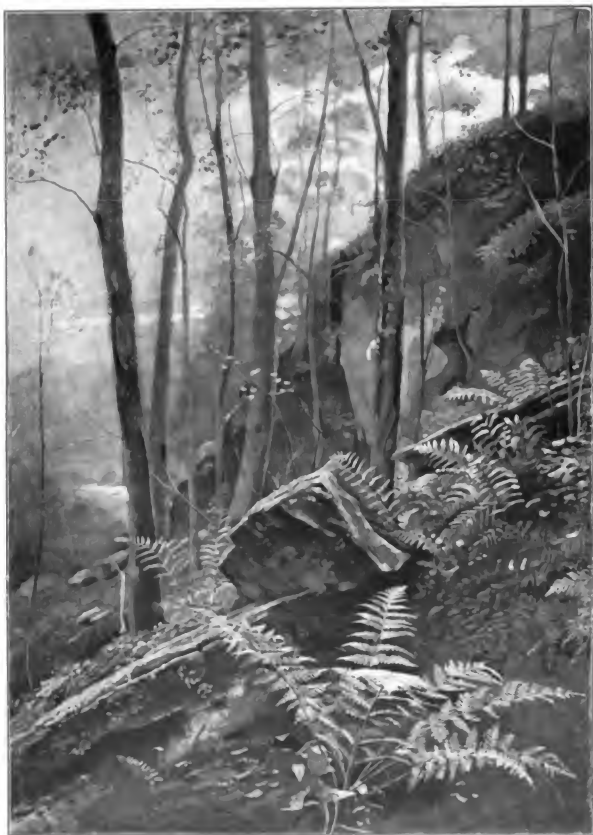
interesting superstitions connected with them. Thus, *marginale* has no reputed mysterious powers to its credit, but is considered of much value as an anthelmintic, a quality which it shares with the male fern.

The marginal shield fern is found from British America to Alabama and Arkansas, being fairly abundant throughout most of this area. It is sometimes called the evergreen wood fern, but in latitudes where several of the wood ferns are evergreen, this title is somewhat misleading. It may be added, however, that it endures the winter better than any of the others. The name of rock fern is somewhat more appropriate. The species is an excellent one for cultivation in shady situations about dwellings.

The Male Fern.

The male fern (*Aspidium filix-mas*) is a widely distributed species. It is plentiful in many parts of Europe and Asia and is found in Greenland and the mountains of South America. In North America, its range is mostly beyond the limits of the United States. It is not uncommon in Canada and has been found in Michigan. In the mountains of the West, it is reported to extend as far south as Arizona.

In general appearance this is so much like the marginal shield fern, that one description would almost answer for both; in fact, short-sighted botanists have called them but two forms of the same species. They are, however, not likely to be so classed by any one who has seen them growing. The frond in this species is broadest above the middle and at base is usually appreciably narrowed. The pinnules are conspicuously toothed



THE HOME OF THE WOOD FERNS.

toward the apices and the rather large sori are borne near the mid-vein instead of on the margin. The fronds are somewhat thinner than those of the marginal shield fern, have not the peculiar blue-green colour and are not evergreen. From the way in which its fronds stand in close circles, it is sometimes called the basket fern. Among its other names are knotty brake fern, sweet brake and vermifuge, the latter referring to its anthelmintic properties.

The stem and roots are bitter and astringent and have been used in lieu of hops in brewing. Its ashes have also been used in glass making. The curious "St. John's hands" once sold to the credulous as charms against magic and witchcraft were made from the rootstock and unexpanded fronds of this species. The rootstock yields the *Filix-mas* of the pharmacist.

Goldie's Shield Fern.

In an order of plants so varied in form and texture as the ferns, there may easily be several standards of beauty. Some, indeed, can scarcely be called beautiful except when seen in masses, others only when taken singly, while still others owe much of their attractive appearance to the setting of mossy rock or shaded brook and lose



THE MALE FERN.
Aspidium filix-mas.

greatly when removed from their natural surroundings. Tried by any of these standards, Goldie's fern (*Aspidium Goldieanum*) will scarcely be found wanting. It is a magnificent species, the tallest of the wood ferns, and almost equalling the *Osmundas* in size.

The fronds are ovate or lanceolate in outline, often four feet high and more than a foot wide and grow from a creeping horizontal rootstock as thick as one's thumb. The stipes of the young crosiers are covered with large pale-brown scales that near the base shade into a deeper tint. The fronds are nearly twice pinnate, the stalked lanceolate acuminate pinnæ being cut nearly to the midrib into long, obtuse, slightly serrate, falcate pinnules. The texture is thin but firm and the colour a peculiar deep blue-green shade, lighter beneath. In colour and cutting of the fronds, this is much like the marginal shield fern, and small forms may sometimes be confused with it, but the pinnæ are not so deeply lobed and the sori are never on the margin as in that species. The fertile fronds are like the sterile and are well fruited by the middle of June. The sori are rather large and borne in a row on each side of the mid-vein and near to it.

Goldie's fern is found from Canada to North Carolina, Tennessee and Minnesota. It delights in deep moist woodlands at medium elevations where there is not much



A FRUITING PINNA.



GOLDIE'S SHIELD FERN. *Aspidium Goldieanum*.

undergrowth. It is not generally distributed in its range, is often rare or missing over large stretches of country, and is seldom as plentiful as *marginale*. It is easily cultivated and its stately fronds form a valuable addition to the fern garden.

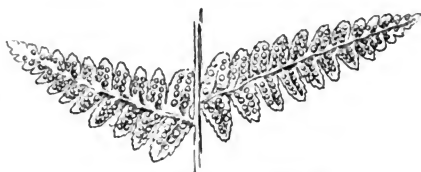
A form of this fern, from the Dismal Swamp has been described as the variety *celsum*. It differs from the type in being narrower, more erect and with pinnules and pinnae further apart.

The Crested Fern.

When one's rambles happen to take him through a piece of wooded swamp full of hellebore and skunk's cabbage, where early in the season the marsh marigold and spring beauty cover the earth with bloom and later in the year the Canada lily hangs out its orange-yellow bells, he is likely to come upon the crested fern (*Aspidium cristatum*) with its tall narrow fertile fronds quite erect in the dim light, as if disdaining the mud in which it is rooted. But this is in summer. If one passes that way again in winter, no fertile fronds are to be seen, but the sterile still remain, fresh and green, though prostrate on the frozen ground and scarcely recognised as belonging to the same plant.

Few species make a more striking distinction between sterile and fertile fronds. It seems to have the nature of two plants in one. The fertile fronds are tall, erect, and found only in summer; the sterile are shorter, spreading and conspicuous only in the winter. In both, the outline is narrowly oblanceolate and acute, and both are pinnate. The pinnae are broadest at the base, the lowest pairs almost triangular and the upper tapering outward to the tips. All are deeply cut into close, broad, obtuse pin-

nules which are crenulate or finely serrate. Occasionally the pinnules nearest the rachis are separate. Fertile fronds sometimes reach a height of three feet and a width of six inches, but these dimensions are rare. The sori are borne in a double row on each pinnule and the indusium is broad, thin and conspicuous. A fruiting pin-nule is illustrated in the Key to the Genera. The rootstock is of medium size, horizontal and creeping.

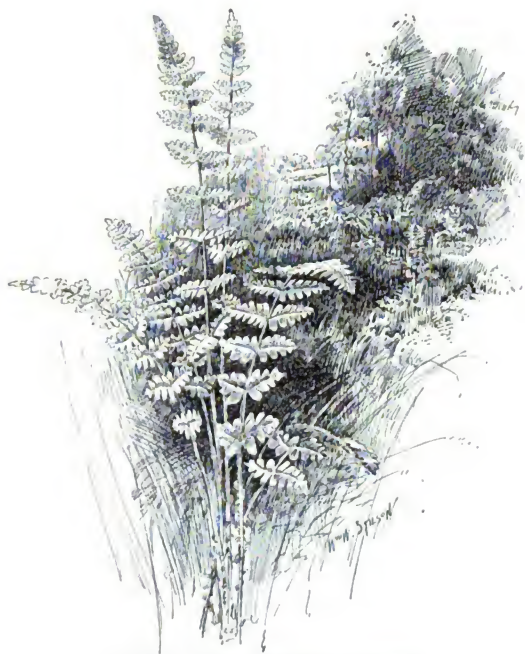


Aspidium cristatum. Middle pinnæ.

The croziers are covered with broad, light-brown scales, many of which remain on the stipes after the blade has unfurled.

This species is very sensitive to varying amounts of light and the pinnæ, especially those of the fertile frond, have the trick of assuming a nearly horizontal position like slats in a blind, to accommodate themselves to the illumination. In fronds that do not naturally receive sufficient light, the individual pinnæ will twist around until at the proper angle. Even when a frond is fastened with the upper side down, they will manage to turn so as to face the light.

The crested fern is found from northern Canada to North Carolina, Arkansas and Idaho and occurs again in Europe and Asia. Its favourite haunt is the woodland

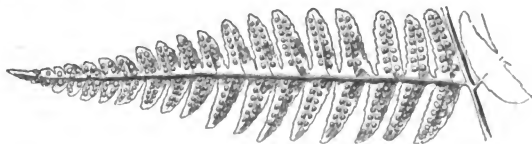


CRESTED FERN. *Aspidium cristatum*.

swamp, though it may be found along streams, in moist thickets and occasionally in the open ground.

A form principally distinguished by its much larger and broader fronds is known as the variety *Clintonianum*. It is found in rich wet woods in America but has not been reported from the Old World. It may sometimes be mistaken for *Goldieanum* but is easily distinguished by its broad triangular lower pinnae.

Mr. Davenport has recently described a curious plant with characteristics intermediate between this species and *marginale* which he calls *A. cristatum* \times *marginale*. He considers it a hybrid and describes it as having the upper part of the frond like *marginale* and the lower third like *cristatum*, with veining and texture like the latter. The rootstock is erect and the frond is very prone to vary and to produce abortive and misshapen fronds. The sori are borne near the margin of the pinnules and the indusium is convex as in *marginale*. Thus far it has been found in various places in all the New England States and in New Jersey.



Aspidium cristatum Clintonianum. Middle pinna.

Aspidium Boottii.

In appearance *Aspidium Boottii* stands half way between the crested and the spinulose shield ferns and is sometimes thought to be a hybrid between them. It has

*Aspidium Bootii.*

also been described at different times as a variety of both species. Present day students, however, unite in considering it distinct. Nevertheless it is a form to puzzle the novice, since it is so easily confused with other species that it often requires careful study to separate them. In the cutting of the fronds it is most like *spinulosum*; in shape it approaches *cristatum*.

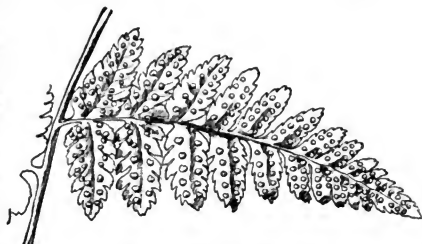
This species attains a height of from two to three feet. The fronds are half erect and oblong-lanceolate in outline. The blade is about twice pinnate. In the lower part, the pinnæ are triangular-ovate and again pinnate with oblong, bluntish divisions, the largest of which are cut into blunt segments with bristle-like teeth at the apex. In the upper, the pinnæ are lanceolate, broadest at base with broad, blunt-toothed segments. The frond is always twice pinnate below, a point that makes its separation from the crested fern easy. It is, however, somewhat variable in its cutting and some forms are likely to be often referred to *spinulosum*.

The fertile fronds are much like the sterile in shape though usually slightly taller and more deeply cut. The sori are rather smaller than those of *cristatum* and borne in a similar double row on the pinnules. Nearly all specimens have a tendency to produce one or more sori on the teeth of the pinnules as well, thus obscur-



Aspidium cristatum Clintonianum.

ing the regularity of the rows. The indusia are minutely glandular. According to some authors a third set of fronds intermediate in size between fertile and sterile and which may or may not



Aspidium Bootii. Lowest pinna.

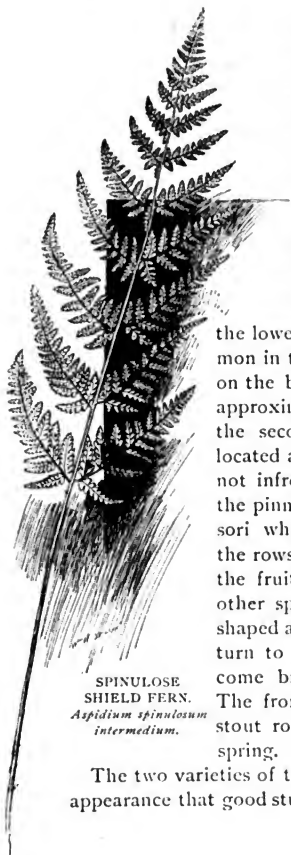
bear sporangia is produced in late summer. This statement would seem to need confirmation. The fronds show their kinship to *cristatum* by the fact that the fertile wither in autumn, while the sterile remain green through the winter.

This species is found from Nova Scotia to Virginia and Minnesota and is also reported from Alaska. It is most abundant in wet shady places and is especially fond of swampy alder thickets. It appears to be fairly common, although in comparison with other wood ferns, it is rare in collections.

The Spinulose Shield Fern.

The spinulose shield fern (*Aspidium spinulosum*) and its varieties are among our commonest species, but their abundance in no wise detracts from their beauty. They are most plentiful in deep moist woods where they flourish in the shelter of rocks and large trees or arch along the mossy banks of streams.

The species may be distinguished from its relatives and from nearly all our other ferns by its finely divided



SPINULOSE
SHIELD FERN.
Aspidium spinulosum
intermedium.

foliage. The blade is nearly three times pinnate, the ultimate pinnules being small, oblong, blunt at the ends and spinulose toothed. The cutting, however, varies greatly. The secondary divisions are not always completely pinnate but they are always so near it as to give a very delicate, lace-like effect to the frond. The pinnules on the inferior side of the pinnæ are frequently elongated especially in the lowest pair, a characteristic very common in this family. The sori are borne on the backs of ordinary fronds in what approximates a double row on each of the secondary divisions, a sorus being located at the base of each pinnule. It not infrequently happens, however, that the pinnules themselves bear one or more sori which breaks up the regularity of the rows and makes the arrangement of the fruit dots less definite than it is in other species. The indusium is kidney-shaped and smooth. The sporangia early turn to a shining black and do not become brown until late in the season. The fronds are produced from a short stout rootstock and all appear in early spring.

The two varieties of this species are so much like it in appearance that good students cannot always agree as to



CRESTED FERN. *Aspidium cristatum*.
Sterile Frond.

the disposition of certain specimens. Generally speaking, it may be said that the variety *intermedium* is rather longer, narrower and more finely cut than the type, with the under surface minutely glandular. The young fronds are frequently so sticky from these glands that they adhere to the paper when pressed for the herbarium. It is our commonest form and is abundant in nearly all moist woods. The variety *dilatatum* is an upland or moun-



A PINNULE. Much enlarged.

tain form, at least in the southern part of its range. It is more inclined to be ovate and the inferior pinnules on the lowest pair of pinnæ are conspicuously elongated. The principal points that are depended upon for separating the forms may be contrasted as follows:—

In true *spinulosum* the scales of the stipe are pale brown, the blade ovate-lanceolate, the pinnæ oblique to the rachis and the indusium glabrous.

In the variety *intermedium* the scales of the stipe are brown with a darker centre, the blades oblong-ovate, often rather narrow, the pinnæ spreading, the indusium ragged edged and dotted with stalked glands.

In the variety *dilatatum* the scales of the stipe are larger, brown with a dark centre, the blade broadly ovate, the lower pinnules much lengthened and the indusium glabrous.

It may be noted in passing that in Great Britain where *dilatatum* is common, and frequently regarded as a dis-

tinct species, the indusium is described as glandular and that according to Eaton, specimens of true *spinulosum* with glandular indusia have been collected in America. The young fern student will encounter no more perplexing problems than the separation of these forms presents. When possible he should compare his specimens with others that are known to be authentic. All are ever-



Aspidium spinulosum dilatatum. Lowest Pinna.

green though the blades do not remain erect during the winter.

This group is found from Canada to North Carolina and northwestward to Alaska. The type is rather rare with us, but is more common in Europe and Asia. *Intermedium* does not seem to be found abroad. *Dilatatum* is the common form in Alaska. It is said that its root-stock is the first vegetable food the Alaska Indians are able to obtain in spring. It is dug before the fronds develop and baked in pits lined with hot stones. It is reported to have a slightly sweetish taste but to be too smoky and tobacco-like in flavour for any but an Indian's palate.

The Fragrant Fern.

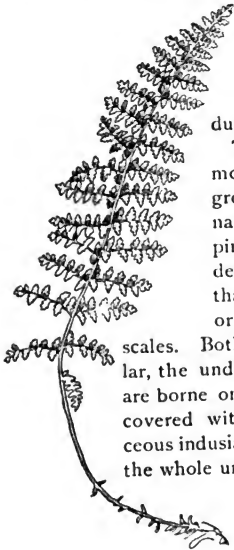
The fragrant fern (*Aspidium fragrans*) cannot be mistaken for any of its relatives, but there are many collectors who would gladly mistake it for anything, if by so doing, they might add it to their collections. It

is a rare and hardy little species, growing in clefts in the face of precipices in the northern parts of our country and yields only to the enduring and persistent fern hunter.

The fronds are usually not more than eight inches long and grow in circular tufts. They are narrowly lanceolate and twice pinnate, the oblong pinnules being deeply toothed. The short stipes that bear them are covered more or less thickly with chaffy brown scales. Both sides of the frond are glandular, the under surface most so. The sori are borne on the narrow pinnules and are covered with unusually large membranaceous indusia. These often entirely conceal the whole under surface of the frond.

A collector who has had the pleasure of finding this fern in a new station, thus writes of it in the *Fern Bulletin*. "There could be no

possible question of its identity, this time. It was way up on the bare dry face of the cliff, far out of reach ex-



FRAGRANT FERN.
Aspidium fragrans.

cept by some sort of a ladder. But it was so unlike any other species with its dry, curling, snuff-coloured fronds of last year, that I knew it was the one I wanted. . . . Its chief characteristics are, first, that peculiar appearance of the old fronds: you couldn't curl them



A Fruiting Pinna.

more gracefully than they appear drooping over the edge of the rocks; second, the glutinous fronds—grass and leaves adhere to them; third, its peculiar fragrance.

Gray says aromatic; that doesn't half tell the story. I gathered a clump of it on the cliff and dropped it down in my pocket handkerchief and the perfume lasted for days. I think it is like new mown hay composed largely of sweetbriar rose leaves. It grows on the dryish cliff sides where anything else would be scorched by the sun's heat. Look for a place where there is a bare cliff, overhanging, a little, perhaps, so that the rain cannot reach it and up above all the trees so that it can have no shade at all, and if you find a fern there, test it by its fragrance, its stickiness and its beautiful brown curls." The fragrance has also been likened to that of primroses, strawberries and raspberries and the plant is known sometimes as the sweet polypody.

The greater part of the fragrant fern's range is north of the United States. It has been found in a few elevated stations in Maine, New Hampshire, Vermont, New York, Minnesota and Wisconsin. Northward it extends to Alaska and Greenland and is reported to be the commonest species in some districts. It is found also in Northern Europe and Asia and is there occasionally used as a tea, being valued as an anti-scorbutic. Al-



FRAGRANT FERN. *Aspidium fragrans*.

though subjected to great cold for a large part of the year, its fronds are evergreen. The illustrations are from Vermont specimens.

The derivation of the names *Aspidium* and *Dryopteris* will be found in the chapter devoted to the marsh fern tribe. The name *Lastrea* by which this genus is commonly known in Great Britain was given in honour of De Lastre a French botanist. As the wood ferns are now grouped there are several well-marked tribes and it is likely that each will ultimately be recognised as a separate genus. In this case certain exotic species with anastomosing veins and circular, peltate indusia will be entitled to the name of *Aspidium*, the free-veined species (which include our wood ferns) to that of *Nephrodium* and those in which the veins connect at the tips to *Lastrea*; though this latter name is really synonymous with *Nephrodium*. The word *Nephrodium* is from the Greek and is in allusion to the reniform indusia.

THE ROCK SPLEENWORTS.

"There be empiricks or blind practitioners of this age who teach that with this herbe not only the hardness and swelling of the spleene but all the infirmities of the liver, also, may be effectually and in a short time removed. . . . But this is to be reconed among the old wives' fables and that also which Discorides telleth of, touching the gathering of spleenwort by night and other most vaine things which are found scattered here and there in old books, from which most of the later writers do not abstaine who many times fill up their pages with lies and frivolous stories and by so doing do not a little deceive young students."—GERARD.

THE ROCK SPLEENWORTS.



THE spleenwort family is one of the dominant fern families of the world, and is represented in eastern America by more species than any other. A strong family resemblance runs through them all, though they present few of the problems in identity so common in other ferns. The young collector will vote them very satisfactory to study. As a group they may be recognised by their bearing sporangia in linear sori that are covered with indusia fixed by their inferior sides and opening toward the midrib. In size and habitat the species fall into two fairly natural groups, the small ones being all rock-loving plants and the large ones preferring to grow in rich earth. The rock spleenworts will be treated of in this chapter.

The Maidenhair Spleenwort.

The dainty little maidenhair spleenwort (*Asplenium Trichomanes*) although not the smallest of the *Aspleniums* is the smallest of our common ferns. After the polypody, it is probably the most abundant of all the strictly rock-loving kinds. It prefers the nooks and shelves of dryish, shady cliffs where it roots in the smallest crevices

and spreads its fronds in green rosettes with very decorative effect. The stipe and rachis are a shining dark brown and the tiny, roundish, or slightly elongated pinnæ, with entire or toothed margins, are scattered along the latter on very short stalks. Sometimes they are slightly dilated on the upper side at base. The whole frond is seldom more than eight inches long and half an inch wide. The number to each plant depends upon its strength and vigour. From ten to twenty is near the normal number, though plants with more than fifty living fronds have been collected. The sporangia are borne in linear sori on the backs of ordinary fronds, several on each pinnule and oblique to the mid-vein. This species has also been known to produce a few sori on the upper surface of the pinnules.

Although so small and delicate, the fronds last through the winter and spring. Then, instead of the entire frond dying, only the pinnules fall, leaving the polished dark rachids standing in a circle about the new growth. One seldom finds a plant without these relics of other days which often greatly outnumber the living fronds. It is said that only the early sterile fronds last through the winter, but this needs verification.

A few years ago, it was discovered that under certain conditions the fronds are capable of movement. The phenomenon is placed on record in the *Botanical Gazette*. The observer found that by quickly bringing a pot containing the growing plant from the ordinarily shaded position into sunlight, or even bright daylight, the fronds made rapid motions back and forth in a direction at right angles to the plane of the frond and "more rapid than the second hand of a watch, but with occasional stops in the course of each half vibration." Only the fruiting fronds have been found to move thus and these

for only a few minutes after being brought into the light. The motions are most vigorous in the middle of the day.

Among the many common names for our plant are wall spleenwort, dwarf spleenwort, black-stemmed spleenwort, English maidenhair, waterwort fern and baby fern. All are derived from the size or appearance of the plant or from the locations it effects. Its fronds are said to be somewhat mucilaginous and astringent and were formerly often substituted for those of the true maidenhair (*Adiantum Capillus-Veneris*) in compounding the famous "Syrup of Capillare." The drying fronds have a sweetish odour which often remains in the herbarium specimens.

The maidenhair spleenwort is one of the most cosmopolitan of ferns. It is found throughout almost all of North America and is as common on the other side of the globe. A British writer says, "The walls of loose stones piled on each other which skirt the road in North Wales are often green for miles with tufts of this fern." It is often supposed that our plant grows only upon calcareous rock but this is certainly a mistake. It is seldom missing entirely from any shaded ledge, and is likely to be among the young collector's first specimens from such places. It takes kindly to the artificial rockery and if planted in the chinks of a rough stone wall will soon cover the gray rocks with its delicate fronds.



Frond of
MAIDENHAIR
SPLEENWORT.

The variety *incisum* with leaflets deeply cut has been reported from various parts of our range. The incised

form from California is now regarded as a distinct species.

The Green Spleenwort.

The green spleenwort (*Asplenium viride*), a rare and delicate little inhabitant of rocky ledges in the North, is at first glance extremely like the maidenhair spleenwort and was once considered to be a variety of it. But while the resemblance is strong, the differences in structure are stronger and there can be no doubt of its being distinct.

The texture of the frond is much thinner



GREEN SPLEENWORT.
Asplenium viride.

than in *A. Trichomanes* and the stipe and rachis are less wiry. The latter is also clear green instead of polished brown. These characteristics alone serve to distinguish this from the commoner species. The fronds are short, pinnate with short-stalked, ovate, round-lobed pinnules and seldom reach a length of six inches. They grow in little tufts from a diminutive rootstock and form dense mats in suitable situations. The sori are



Frond of
GREEN
SPLEEN-
WORT.

borne on the backs of ordinary fronds, several on each pinnule and slightly nearer to the middle than the margin. The indusium, of course, is linear.

In the eastern United States, the green spleenwort is found only in Vermont. Further north it is slightly more abundant and is generally distributed throughout British America, reappearing in our Western States in the mountains of Oregon, Wyoming and Washington. It is also found in Greenland and in the colder parts of the old world. Over seas this species grows with the maidenhair spleenwort and in our own country selects much the same habitats. It is occasionally called green maidenhair. We illustrate a Vermont specimen.

The Small Spleenwort.

The small spleenwort (*Asplenium parvulum*) is a southern species which careless collectors might gather for the maidenhair spleenwort or perhaps the ebony spleenwort. It grows in tufts on shaded, or sometimes on sunny cliffs, the fronds spreading from a short half-erect rootstock. The stipe and rachis are very dark brown and polished but are much more rigid than in the maidenhair spleenwort. The fronds are also thicker, almost leathery in texture and much broader.

In shape the fronds are linear-lanceolate and once pinnate with many pairs of opposite, oblong, blunt pinnules that are usually slightly cared on the upper side at base. In the larger fronds, which may occasionally reach a length of ten inches, there is a tendency to produce an ear on the inferior bases of the pinnules also. This is especially noticeable in the shortened lower pinnules which thus often become triangular. The sori are borne on

the backs of the ordinary fronds in a single row near the edge of each pinnule, the individual sori oblique to the rachis.

In size, shape and habitat, this species seems to stand halfway between the maidenhair and ebony spleenworts. It was once considered a variety of the latter and is sometimes called the little ebony spleenwort. The points by which it may be distinguished from the maidenhair spleenwort have been mentioned. It may be well, also, to contrast it with the ebony spleenwort. For all their resemblances, it will be found upon comparing the two that they have very little in common.

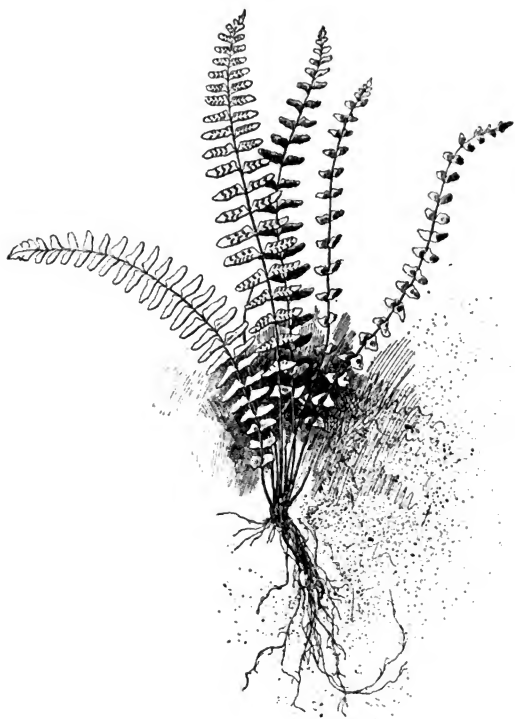
In *parvulum* the fronds are small, thick, stiff, with entire, deflexed pinnæ. Fertile and sterile fronds are of the same size.

In *ebeneum* the fronds are larger, thin, flexible, with serrate horizontal pinnæ and the fertile fronds are much the taller.

Asplenium parvulum is found from Virginia and Kansas south and southwestward to the tropics. In the mountains of Jamaica it frequently grows on wayside banks and old stone walls, often in full sun.

The Ebony Spleenwort.

The ebony spleenwort (*Asplenium ebeneum*) loves the rock as much as any of its kin, but only rarely is it found on the shelving sides of cliffs. I have found it thus along the Palisades of the Hudson, but it had evidently strayed down from its home at the top. It especially delights in thin stony soil and comes to its best in half wooded lands in a tangle of small bushes, brambles and clumps of the New York and boulder ferns. It also



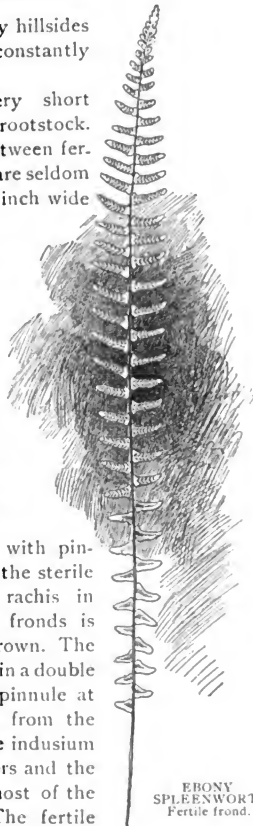
SMALL SPLEENWORT. *Asplenium parvulum*.

manages to exist upon many shaly hillsides where the falling fragments are constantly crowding its fronds.

The fronds are borne on very short stipes in tufts from a small rootstock. There is a noticeable difference between fertile and sterile blades. The latter are seldom more than six inches long and an inch wide and spread close to the earth. They are once pinnate with close set, short, blunt and obscurely serrate pinnules eared on the superior side at base. The fertile are three or four times longer, stiffly erect, in marked contrast to the others. The pinnules are also much longer, often an inch or more in length, usually conspicuously serrate and inclined to be eared on both sides at base. They are about linear-oblongate, tapering acutely below and with pinnules much farther apart than in the sterile



frond. The rachis in both kinds of fronds is dark shining brown. The sori are borne in a double row on each pinnule at some distance from the margins. When young the white indusium is conspicuous, but it soon withers and the sori, becoming confluent, cover most of the under surface of the frond. The fertile



EBRONY
SPLEENWORT.
Fertile frond.

fronds do not survive the winter, but the sterile are evergreen. In this, as well as in the way the plant carries its two sorts of fronds, it strongly suggests the crested fern. Part of a fruiting frond is shown in the Key.

The ebony fern derives its name from the dark rachids. It is said that the word ebony is from the Hebrew *eben* meaning a stone. In its application to this species, it is particularly appropriate, since it may be taken to refer to the colour of the rachis, or to the fern's habit of growing among the rocks. It is also called screw fern because the alternate fertile pinnæ are set upon the rachis in such a manner that they resemble the threads on a screw. While the plant is growing, the resemblance at a short distance is very striking.

This species is found from Maine and southern Canada to the Tropics and westward to Colorado. It is not abundant except in rocky soil. It grows well in cultivation and is said to occasionally root at the apex.

The pinnules incline to vary in the depth of the serratures. Deeply incised forms have been described as the varieties *incisum* and *serratum*. Fronds with pinnatifid pinnæ and serrate pinnules have also been reported. This species, like the maidenhair spleenwort, is some times sweet-scented in drying. The odour seems to come from the roots or rootstock and often remains for some time in the dried plants. Until recently our fern has been called by the specific name of *ebeneum*. There is a much older name and if we should go back to this, our plant would be known as *Asplenium platyneuron*.

The Wall Rue.

The wall rue (*Asplenium ruta-muraria*) is usually found in limestone regions. It loves the sheltered



EBONY SPLEENWORT. *Asplenium ebencum*.

nooks on dry cliffs and often grows luxuriantly in the smallest crevices. In comparison with many of its allies it may be called common and next to *A. Trichomanes* is the spleenwort oftenest found on cliffs.

The fronds grow in tufts from a short rootstalk and are seldom more than five inches long, while fruiting specimens only an inch high are not rare. In shape, they vary from ovate to oblong-ovate and are twice pinnate with stalked pinnæ and pinnules. The pinnæ are shaped like the frond, and the pinnules are ovate, obovate or fan shaped with the outer margin slightly toothed. Occasionally the pinnules are lobed or again pinnate. In texture the fronds are thick and leathery and they endure the winter without injury. Several sori are borne on each pinnule and nearly every frond is fertile. The indusium soon withers and the sori become confluent over nearly all the under surface.

Small as this species is, it does not lack for common names. Among them, wall rue and stone fern are in allusion to its place of growth, and white maidenhair from its being confused with the maidenhair spleenwort. Its old name of tent-wort was originally taint-wort and was given because the plant was supposed to be a specific for a scrofulous disease called "the taint." The fronds were once considered good for coughs and for diseases of the liver and spleen, but their use for such things has now been abandoned.

The rue spleenwort is found from Vermont,

THE WALL RUE.

Asplenium ruta-muraria. Three forms of fronds.



southern Ontario and Michigan to Alabama and Missouri, always on rocks. It is also widely distributed in the Old World. Newman in his "British Ferns" says that throughout the northern, southern and western counties of England and also in Wales, Scotland and Ireland, this fern is to be found upon almost every ruin. It is never so common with us and the collector who discovers it in a new place is fortunate. Mrs. Parsons, in "How to Know the Ferns," mentions a clump of this fern no larger than the palm of one's hand, in which forty-five fresh fronds were counted. The plant is not very easily cultivated.

The Mountain Spleenwort.

The mountain spleenwort (*Asplenium montanum*) greatly resembles the wall rue in everything except numbers, but the latter characteristic will prevent its often being mistaken for that species. It was first discovered in the Carolinas by Michaux who supposed it to be an Old World species, *Asplenium Adiantum-nigrum*. The points by which it may most readily be distinguished from the wall rue, are the less fan-shaped pinnules and the longer and narrower fronds.



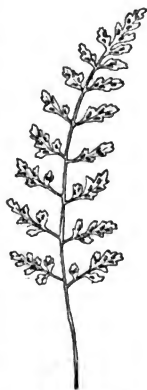
MOUNTAIN SPLEENWORT.
Asplenium montanum.

The rootstock is small and short-creeping, often producing short stubby lateral branches. The fronds are spreading and when full grown are from two to six inches long. They are about ovate-lanceolate, twice pinnate at the

broad base and graduated upward to the pinnatifid apex. The lower pinnæ are stalked and elongated-triangular in shape, with lanceolate and sharply toothed pinnules, as are also the pinnules near the tip of the frond. None of them appear to be decidedly wedge-shaped. The short sori are borne on most of the fronds and early become confluent over the under surface as in the wall rue. Occasionally the lower sori are double. Fronds ten inches long are reported from Kentucky, and Williamson is quoted as having collected a plant in that state having more than fifty fronds.

The mountain spleenwort is found sparingly from Connecticut and New York to Georgia and Arkansas. It is an inhabitant of the precipices in mountainous regions and frequently grows in inaccessible niches. Lantern Hill in Connecticut, near the Rhode Island State line is its limit, northeastward so far as known. Writing of this station for it, in the *Fern Bulletin*, Dr. C. B. Graves says, "*Asplenium montanum* is able to maintain itself on the driest and most exposed cliffs provided there are holes and crevices which afford a holding place. In such situations it is much stunted and inconspicuous, the fronds sometimes fruiting when less than half an inch in length.

It reaches its best development on moist, shaded, overhanging ledges." This species usually chooses situations similar to those selected by the wall rue, and may be looked for wherever the latter is found. No doubt there



Fertile frond of
MOUNTAIN
SPLEENWORT.

are many stations for it in the eastern States that await a discoverer.

Asplenium Bradleyi.

It was once suggested that *Asplenium Bradleyi* might be a hybrid between the ebony and mountain spleen-words, but the idea seems more ingenious than plausible since a well developed specimen has as much individuality about it as any other member of this group. Like the others, it loves the rocks and is often able to thrive in full sunshine but is at its best in shady places.

The fronds grow in tufts from a short and nearly erect rootstock and often reach a length of ten inches. They are rather narrow, slightly broadest at base and taper upward. The pinnules nearest the apex are oblong or ovate and serrate, those next below are deeply serrate while those at the base are again pinnate with oblong, blunt, sometimes toothed pinnules. The basal pinnæ have

broad bases and blunt tips and are slightly stalked. The stipe and rachis are dark brown and the sori are as in the other *Aspleniums*.



Fruiting pinnæ of
Asplenium Bradleyi.

This species ranges from New York to Georgia and Missouri. It is supposed to keep pretty close to the limestone, but has been found on sandstone in Missouri and Ken-

tucky and on gneiss in Maryland. As yet it is not known to be very abundant anywhere but will no doubt be found in many more localities. There is much differ-



Asplenium Bradleyi.

ence between the extremes of variation in the fronds. In appearance certain forms approach very closely to forms of *A. montanum*. Mr. C. E. Waters, in the *Fern Bulletin*, gives this rule for distinguishing them, "In *montanum* the stipe is brown only at the base and the upper part of the stipe and the entire rachis is flattened, with two parallel grooves in front. In *Bradleyi* the entire stipe and lower part of the rachis is brown while in place of two grooves we have a single distinct one with a slight ridge running down the centre." Our illustration was made from plants collected in Missouri.

The Pinnatifid Spleenwort.

It is always a red letter day in one's calendar when he chances upon the crinkly, dark-green, tapering fronds of the pinnatifid spleenwort (*Asplenium pinnatifidum*) peeping from a cleft in some gray cliff. This species is one which the collector ever has in mind when searching the shady ledges, for it belongs to that rare class of plants whose location cannot be determined beforehand. One visits the woods, the swamps and the ravines in perfect confidence of being able to find certain species, but the pinnatifid spleenwort is not one of them. Although it has a considerable range it is common only in a few restricted areas. To most of us, it comes as a sort of gift of the gods, and makes memorable the day on which it was found.



Asplenium pinnatifidum.
A fertile frond.

The rootstock is short, nearly erect and usually roots in a crevice well out of ordinary reach. The fronds, some six inches or less in length, are broadest at base and taper outward to a long slender tip that often roots after the manner of the walking fern; in fact the whole plant suggests the latter species and it is not surprising to learn that it was once considered a variety of it. It is, however, clearly distinguished by its free veins, and mostly single indusia, not to mention its pinnatifid fronds.

The fronds are thick and evergreen. At some distance from the tip they begin to be round lobed and these lobes grow larger and the cutting deeper as the base is approached, until the lowest often become separate pinnæ, rather rounded triangular in outline. The stipes are usually short, but vary in length with the location of each plant, being always long enough to lift the blade clear of the crevice in which it is rooted. There is considerable variation in the fronds. Forms that are pinnate nearly to the summit, with ovate pinnæ, have been found, and others with long, sharp-pointed pinnæ at the base of the frond are known. The sori are borne both upon the lobes and the tapering apex, many of them opening toward the inferior edges.

The pinnatifid spleenwort is found from New York to Illinois, Arkansas and Georgia. Throughout most of its range it is extremely rare though in some small sections it is not uncommon. It has been found on limestone, gneiss and sandstone and will probably yet be found on shale. Within its range the collector is always warranted in expecting it, though he is probably destined to be very frequently disappointed.

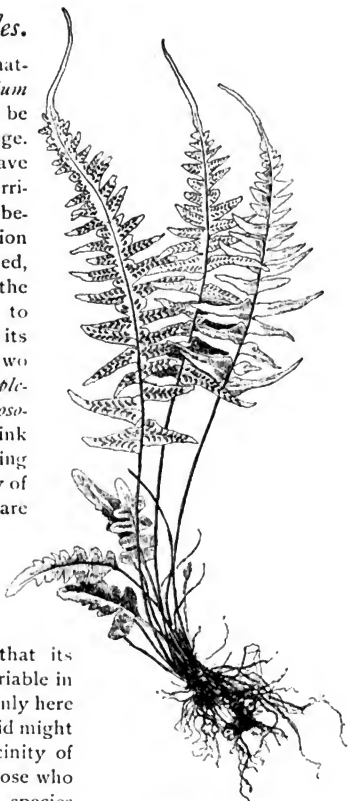


PLATE V THE PINNATIFID SPLEENWORT *Asplenium pinnatifidum*

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Asplenium Ebenoides.

Still rarer than the pinnatifid spleenwort is *Asplenium ebenoides*. It can hardly be said to have a definite range. Here and there plants have been found over a wide territory, and new stations beyond its known distribution are occasionally reported, but in nearly every case the surroundings are such as to indicate the possibility of its being a hybrid between two more common ferns, *Asplenium ebeneum* and *Camptosorus rhizophyllus*. Much ink has been wasted in arguing for and against this theory of hybridity and botanists are still divided in opinion regarding it. Those who favour the theory point as evidence to the facts that the spores are generally abortive, that its fronds are exceedingly variable in shape, and that it occurs only here and there as a chance hybrid might do and always in the vicinity of its supposed parents. Those who believe it to be a distinct species

*Asplenium ebenoides.*

reply that though widely scattered, in no case is its habitat exactly like that of its supposed parents; for while the ebony spleenwort grows at the tops and bases of cliffs, and *Camptosorus* grows on the shelving sides of mossy rocks, *Asplenium ebenoides* prefers the niches under overhanging ledges. In addition, the processes of reproduction in ferns are such as to afford very small chance for hybridization. If, following Lowe's successful experiments in crossing ferns by sectioning the prothallia and bringing the antheridia of one fern in contact with the archegonia of another, we could produce a plant like *ebenoides* from the sectioned prothallia of its supposed parents, the fact of its hybridity might be regarded as proven. Experiments are being made in this direction at present, but until we have definite results, it seems better to consider this a distinct species.

In outline the fronds are much like those of the pinnatifid spleenwort, but are not easily confused owing to the fact that the pinnules are thinner, narrower, longer and pointed. The blade tapers from a broad base to a slender tip and is fully pinnate below and deeply pinnatifid above. There is great diversity in the shape and arrangement of the pinnules, however. Some are eared on one side, some on both, others not at all but are attached to the rachis by a broad base. The pinnæ are very unequal in length, the longest often standing next to one that is merely a short green ear. Some fronds, which appear to be juvenile examples, have a broad blunt apex and the lower portion merely toothed or lobed. In this feature of producing some fronds without tapering tips, it resembles the walking fern. The figure in Eaton's "Ferns of North America" does not much resemble average specimens. Like the pinnatifid spleenwort, this

species produces young fronds at the apex, but only rarely. In plants that have this tendency to be viviparous, a sudden check, as by cold, just as the fronds are fruiting, is said to greatly increase it. In cultivation the production of young plants in this way is much more common than when they are growing wild. The sori are seldom plentiful and are borne in a double row on each pinnule and open toward the midvein. The spores are frequently, perhaps always, abortive.

This species has been reported from stations in Vermont, Connecticut, New York, New Jersey, Pennsylvania, Virginia, Illinois, Indiana, Kentucky, Missouri and Alabama, but the records usually rest upon very few specimens, often only one. So far as known, there is only one locality where it is plentiful—a deep ravine near Havana, Alabama.

Prof. Underwood who collected it in this spot writes as follows concerning it. "Its nearest congener is *Asplenium pinnatifidum* but the frond is much thinner than in that species. In habitat, however, it is very close to that species, growing under overhanging rocks; in this respect it is totally unlike both *A. ebencum* and *Camp-tosorus*, its supposed parents. It appears to be multiplying, as many young plants were seen in the rock crevices. This myth of hybridity may be put aside, for *Asplenium ebenoides* is as clearly defined a species as we possess in the genus *Asplenium* and has no near relatives outside its own genus." The plant figured was collected by Prof. Underwood at the Alabama station.

There are two other spleenworts for which a place is sometimes claimed among American ferns, though the proof of their occurrence in this country rests upon

somewhat doubtful evidence. The first is *Asplenium marinum* which fifty years ago was reported from Nova Scotia and Newfoundland. No specimens of it from America are known at present and it is supposed that the fern was referred to this country by mistake. The plant is not uncommon along the coast on the other side of the Atlantic and may yet be found in New England on some rocky ledge near the sea. It is an evergreen species, growing in tufts, with thick linear-lanceolate fronds of a deep glossy green. They are usually about six inches long and borne on short dark-brown stipes. The blade is simply pinnate with short, broad, blunt, toothed pinnæ connected along the rachis by a narrow wing of tissue.

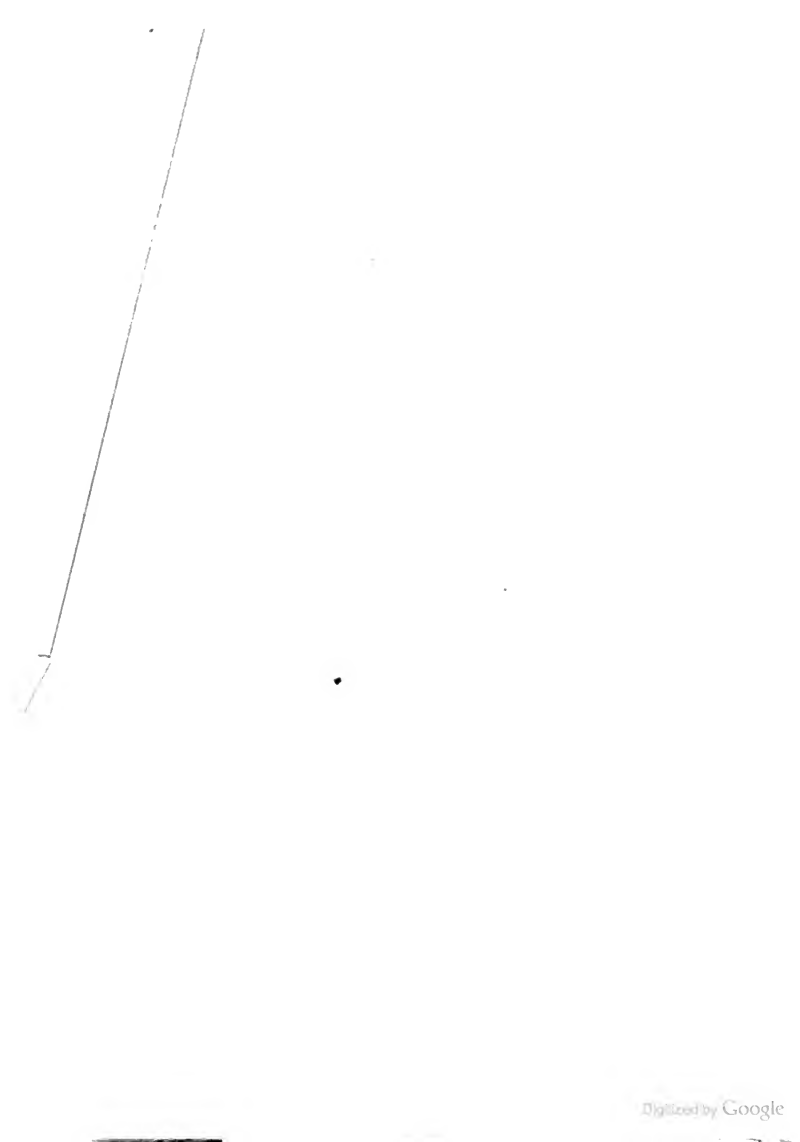
As to the second species, *Asplenium fontanum*, the evidence is fully as uncertain. It is supposed to have been collected near Williamsport, Lycoming Co., Penn., in 1869 and sent with other specimens to Prof. T. C. Porter of Lafayette College, where it lay unrecognised for twenty years. By the time the plants were identified as specimens of *A. fontanum* and connected with the Williamsport locality, the collector had died and with him died the knowledge of the exact locality for the plant, if, indeed, he ever collected it. Two sharp-eyed collectors who at once ransacked the general region returned empty handed and no trace of it has since been found. Later another locality for the plant was reported from Ohio, also by Prof. Porter, who found specimens among plants distributed by a local collector. No locality for these specimens has since been found and it would seem that the plant has been mistakenly ascribed to America. The fern is common in the Old World, however, and possibly may

occur here. It is described as follows : Rootstock short, ascending ; stipes tufted, one to three inches long, somewhat blackish at base especially on the inner side, usually glabrous ; fronds lanceolate, broadest above the middle, thin, two to three pinnate, three to six inches long, acuminate at the apex, narrowed at the base ; segments deeply dentate with spinulose teeth ; sori one to four on each segment. The indusium is slightly curved, and for this reason it is often proposed to place this species with the *Athyriums*. Our illustration is drawn from specimens from Central Europe, in the author's herbarium.

*Asplenium fontanum*

The generic name *Asplenium* is derived from the Greek and means without a spleen in allusion to the belief once current that herds which fed upon this plant were without spleens. In an old volume we find the statement that "If the asse be oppressed with melancholy, he eats of this herbe and so eases himself of the swelling of the spleen." There are about three hundred and fifty species in the world.

THE LADY FERN AND ITS KIN.



"If you would see the lady fern
 In all her graceful power,
 Go look for her where woodlarks learn
 Love-songs in a summer bower.

 Go look for the pimpernel by day,
 For Silene's flowers by night,
 For the first loves to bask in the sunny ray,
 And the last wooes the moon's soft light;
 But day or night the lady fern
 May catch and charm your eye,
 When the sun to gold her emeralds turn
 Or the moon lends her silvery dye.
 But seek her not in early May
 For a Sibyl, then, she looks,
 With wrinkled fronds that seem to say,
 'Shut up are my wizard books.'
 Then search for her in the summer woods
 Where rills keep moist the ground,
 Where foxgloves from their spotted hoods
 Shake pilfering insects round;
 Fair are the tufts of meadowsweet
 That haply blossom nigh,
 Fair are the whorls of violet
 Prunella shows hard by;
 But not by burn, in wood or dale,
 Grows anything so fair
 As the plummy crests of emerald pale
 Of the lady fern, when the sunbeams turn
 To gold her delicate hair,"—CAMPBELL.

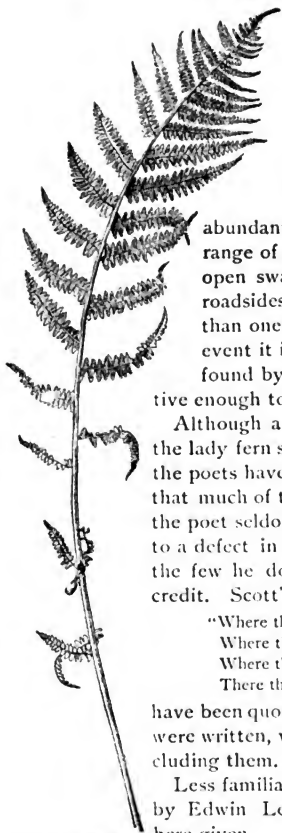
THE LADY FERN AND ITS KIN.



IN our latitudes the earth-loving spleenworts are all tall and graceful plants with very little in their bearing to suggest a relationship to the members of the family that grow on rocks. They are more like some of the wood ferns and no doubt are frequently mistaken for them. A glance at the sori on mature fronds, however, is quite sufficient to settle the question, since it will show the *Asplenoid* character of the linear sori. These species have always been classed as *Aspleniums* in America but owing to the fact that the indusia in some are more or less curved on the side attached to the frond and when young often appear to be nearly semi-circular, it is now considered better to follow the British practice and place them in the genus *Athyrium*.

The Lady Fern.

Our ideas as to which of the ferns is most abundant, are likely to vary somewhat with the time of year and the locality in which we may happen to be. In early May, we are inclined to award the palm to the cinnamon fern; in July, to the bracken; while a visit to some moist



LADY FERN.
Athyrium filix-femina.

shady woodland at any time of year might decide us in favour of some wood fern. But the matter can not be regarded as decided until the claims of the lady fern (*Athyrium filix-femina*) have been considered.

While it may not be the most abundant in any one locality, its wide range of habitat from deep woodlands to open swamps, stony pastures and dusty roadsides gives it a larger representation than one would at first imagine. In any event it is always common enough to be found by the young collector and attractive enough to be worth the finding.

Although a pretty and decorative species, the lady fern seems scarcely to deserve all that the poets have said of it. It is barely possible that much of this praise is due to the fact that the poet seldom feels sure of his species, owing to a defect in his botanical education, and so the few he does know come in for all the credit. Scott's four lines,

"Where the copse-wood is the greenest,
Where the fountain glistens sheenest,
Where the mountain dew lies longest,
There the lady fern is strongest."

have been quoted in every fern book since they were written, which must be our excuse for including them.

Less familiar are the fairly descriptive lines by Edwin Lees of which three stanzas are here given.

"When in splendour and beauty all nature is crowned
The fern is seen curling, half hid in the ground,
But of all the green brackens that rise by the burn,
Commend me alone to the sweet lady fern.

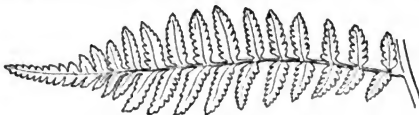
By the fountain I see her just spring into sight,
Her texture as frail as though shivering with fright;
To the water she shrinks, I can scarcely discern
In the deep humid shadows the soft lady fern.

Where the water is pouring, forever she sits
And beside her the Ouzel, the Kingfisher flits;
There supreme in her beauty, beside the full urn
In the shade of the rock, stands the tall lady fern."

The following lines from Howitt were sent to the author by a lady who suggests that the last one may have been intended as a hint to those vandals who delight to uproot and carry away all they can find of a rare plant, simply because it is rare.

"And when thou art in lonely glen,
Keep by the running burn,
And do not pluck the strawberry flower
Nor break the lady fern."

In my opinion the most quaint and descriptive poem upon



Pinna of variety ovatum. A common form.

this species is the one by Calder Campbell, parts of which preface this chapter.

The fronds of the lady fern spring in circular tufts from a large horizontal rootstock and often reach a

length of three feet. The crosiers are of interest from the colours they present early in the year. In some varieties the stipes are a clear wine colour with light, thin scales and contrast very prettily with the yellow-green of the uncoiling blades. The blades themselves are on long stipes and are exceedingly variable in the cutting of the pinnules. Nearly a hundred varieties from Europe have



Fruiting pinnule enlarged.

been described. The commonest form with us is probably that with oblong-ovate, acute, twice pinnate fronds with the secondary pinnæ again lobed or toothed. The primary pinnæ are about oblong-lanceolate, acute or acuminate, and set at sufficient distances from each other to render the frond light and graceful. Mr. B. D. Gilbert has recently identified some twenty varieties from American localities, none of which are the results of cultivation. This species is noted for having pinnules missing here and there throughout the fronds.

Ordinarily there is scarcely any difference in the appearance of fertile and sterile fronds. The sori are borne in a double row on each pinnule and the indusia are attached to the frond by a curving edge.



A form from sunny thickets.

When young they extend in the shape of a horse-shoe across the veins which bear them. The novice who examines them at this stage of their growth may jump to the conclusion that his plant is some species of *Aspidium* but later the sori become almost straight as in the true

Aspleniums. It is a nice question to decide whether or not the position and behavior of the indusium entitle this fern to be put in a separate genus.

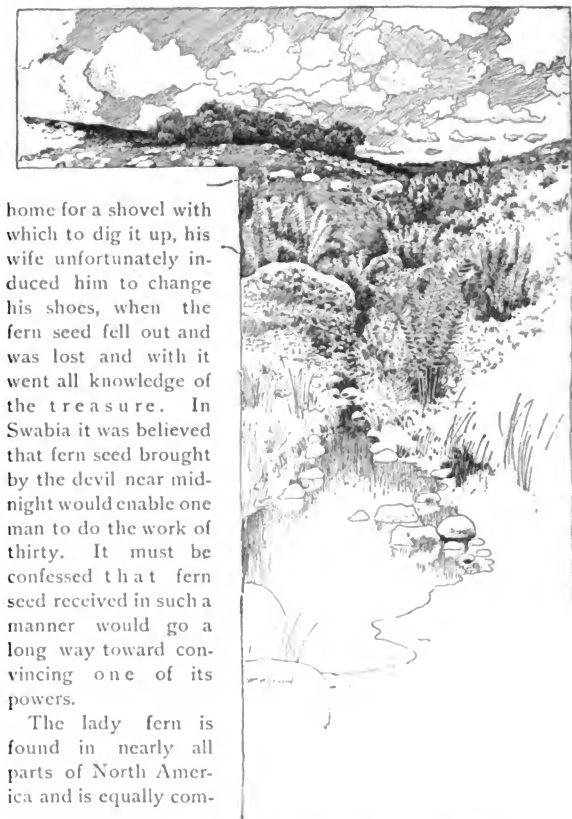
The name of lady fern is of very ancient origin, going back to the time when this was supposed to be the species which bore the "mystic fern seed," so valued for its reputed power to render its possessor invisible. In those days it was not lady fern, but female fern, the male fern being *Aspidium filix-mas*. The original female fern was the bracken, but when the name was transferred to this fern, many of the miraculous powers ascribed to the bracken seem to have come with it. Some curious stories



A woodland form.

are told of this wonderful fern seed. In one, a man, passing through a wood when the seed was ripe, got some into his shoes without knowing it, which of course rendered him invisible. Reaching home he entered, but his presence was not noticed. When he spoke, the family were startled at the sound of his voice and supposed him to be hiding. At length, hearing him walking about the room, they thought of the fern seed, and calling to him to take off his shoes, he did so, and became visible again.

In Russia, in addition to its other virtues, fern seed was supposed to confer second sight. It is related that a man went out to search for his cattle, when some fern seed fell into his shoes. He at once knew where his cattle were and discovered a buried treasure besides. Going



home for a shovel with which to dig it up, his wife unfortunately induced him to change his shoes, when the fern seed fell out and was lost and with it went all knowledge of the treasure. In Swabia it was believed that fern seed brought by the devil near midnight would enable one man to do the work of thirty. It must be confessed that fern seed received in such a manner would go a long way toward convincing one of its powers.

The lady fern is found in nearly all parts of North America and is equally com-

THE HAUNTS OF THE LADY FERN.

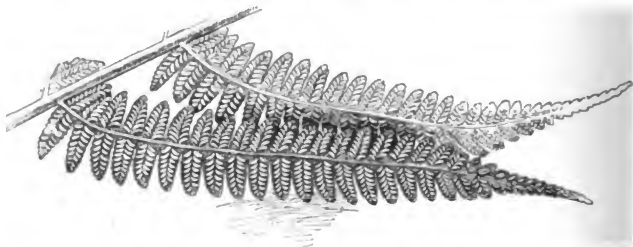
mon in the Old World. It is one of the easiest of ferns to cultivate and will grow in almost any soil if given moisture and partial shade. This species is frequently called a brake, and is also occasionally known as backache fern. The rhizome of the European species is erect or ascending and commonly rises a few inches above the soil. That of our plant is long and creeping, which seems to indicate that the two are not identical. In this case our plant would be known as *Athyrium Michauxii*, or perhaps more properly *Athyrium filix-femina Michauxii*. In northwestern America there is a form that is taller and broader, with indusia so curved that they appear almost circular with a narrow sinus. It was formerly considered a variety of the lady fern and named *cyclosorum*. It is now generally thought to be a distinct species.

The Silvery Spleenwort.

The best place to look for the silvery spleenwort (*Athyrium thelypteroides*) is in the rich moist woods on the borders of the crested fern's haunts where it delights to grow among the Jack-in-the-pulpits, Trilliums, Solomon's Seals and other lily-like plants. It is an unassuming plant as ferns go, with few characteristics sufficiently striking to make it prominent among its sister species. Unless one is making a clean sweep of every woodland, it is possible for it to exist in his locality for years without being discovered. When growing in clumps, its resemblance to some of the wood ferns, especially the marsh and New York ferns, is quite close.

The rootstock is thick, horizontal and creeps near the surface. The fronds are produced singly from the grow-

ing end but soon form a nearly circular clump two or three feet high. The stout young crosiers are covered with large brown scales which seldom persist until the fronds mature. The stipe and rachis are strewn with slender chaff and the upper surface of the fronds is often covered with longish hairs that give it a peculiarly velvety effect when growing. It is not very noticeable



SILVERY SPLEENWORT. *Athyrium thelypteroides*.

in herbarium specimens, and the books are silent upon the subject, although in the field one can often identify the species by this single feature.

The blade is about oblong, tapering both ways from the middle, but is never so greatly reduced below as is that of the New York fern. It is thin and delicate, with oblong, acuminate pinnæ cut nearly to the midrib into short, close, rounded, obscurely serrate lobes. When the fronds are exposed to the sun, the blades become thicker, narrower, more erect and yellow-green in colour. Curiously enough, although they do not grow in full sunlight from choice, they are most fruitful in such situations. The stipe is about one third the length of the frond.



SILVERY SPLEENWORT. *Athyrium thelypteroides*.

Fertile and sterile fronds are much alike and the former are sharply distinguished from those of other species by their regular rows of clear-cut sori. Beginning at the base of each pinnule, these alternate on each side of the midvein almost to the tip. They are usually set close together and curve slightly outward at an oblique angle nearly to the edge of the pinnule in a very pleasing pattern. Occasionally the lower sori are double, opening away from each other, and on the long slender tips of the pinnæ they are nearly always so. In heavily fruited fronds the fruit covers nearly all the under surface of the blade. The indusia are rather thick and for most of the summer retain the silvery white colour of their youth thus giving the common name to the plant. The fronds do not survive the frosts.

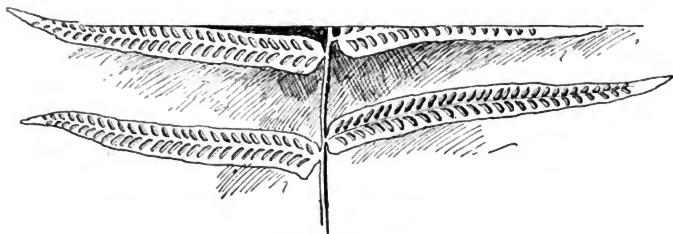
This species is found from Canada and Minnesota to Alabama. It also occurs in Eastern Asia. It is considered a fairly common species—never so common as the lady fern, perhaps, although often forming dense thickets in small areas. After studying it for many years, I am inclined to agree with the author of "How to Know the Ferns" that "although it cannot be classed among the rare things, it is absent from many promising localities." American authors frequently give this species the name of *Asplenium acrostichoides*. This is the older by three years, but has never been commonly accepted.

The Narrow-Leaved Spleenwort.

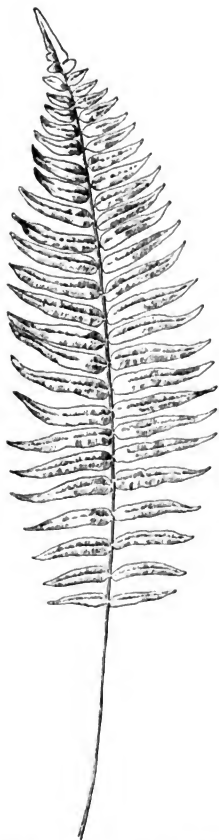
The rarest of the larger *Aspleniums* is without doubt the narrow-leaved spleenwort (*Asplenium angustifolium*). According to Eaton, it has no very near relatives anywhere. It is a true *Asplenium* and not an *Athyrium*,

but except for its fruiting characters, it is more nearly like the species in the latter genus and has therefore been included in this chapter. It is found in low woodlands in situations similar to those chosen by the silvery spleenwort though seldom if ever so abundant as that species.

The fronds grow in tufts from a creeping rootstock and sometimes reach a height of four feet, though they are usually at least a foot shorter. They are exceedingly thin and delicate, very sensitive to frosts and are often destroyed by summer storms. The oblong-lanceolate, acute blades are simply pinnate with many long, narrow, entire or crenulate pinnules which taper outward from a rounded, sessile, or shortly stalked, base to the slender tips. The fertile fronds are usually the taller and the pinnules much narrower with the whole under surface covered by the long, sharply defined sori in two rows along the midrib of each pinnule, much as in the silvery spleenwort. Normally sterile fronds sometimes have a few pinnules that are fertile in which case the spore-bearing parts are narrow like the pinnules of the fertile frond, showing how close is the relationship between



FRUITING PINNÆ.



NARROW-LEAVED SPLEENWORT. *Asplenium angustifolium*.
Sterile Frond.

spore-bearing and diminished leaf surface in this species.

The narrow-leaved spleenwort is found from Quebec to Wisconsin, Missouri and Tennessee. It is likeliest to be found in woods that are free from undergrowth. Its liking for wet places obtains for it the name of swamp spleenwort in some places and it is also called Kidney-fern. It is easily cultivated and makes a very pretty addition to the fern garden where tall species with simply pinnate fronds are not common.

There are probably less than a dozen species in the genus *Athyrium* as it is at present defined. The generic name is from a word meaning opened and refers to the appearance of the sori. The origin of the name *Asplenium* is given in the chapter on the Rock Spleenworts.

THE POLYPODIES.

"It is very pleasant and cheerful nowadays, when the brown and withered leaves strew the ground and almost every plant is fallen, to come upon a patch of Polypody . . . on some rocky hillside in the woods, where in the midst of dry and rustling leaves, defying frost, it stands so freshly green and full of life. My thoughts are with the polypody a long time after my body has passed, . . . The forest floor is covered with a thick coat of moist brown leaves, but what is that perennial and springlike verdure that clothes the rocks, of small green plumes pointing various ways. It is the cheerful community of the polypody. It survives at least as the type of vegetation to remind us of the spring that shall not fail.—THOREAU.

THE POLYPODIES.



Phegopteris Dryopteris.

THE polypodies belong to the largest of the fern families. There are nearly four hundred species in the world, mostly in the Tropics. Only five species extend into northeastern America, and three of these are considered by many botanists to belong to a closely allied genus which they name *Phegopteris*. This name, it may be said, was once the name of a section of the genus *Polypodium* and those who call our plants species of *Phegopteris*, simply consider this section worthy of generic rank. As in the true polypodies, the fruit dots are without indusia of any kind but the phegopterids differ in having the fruit on the *backs* of the veins while in the *Polypodiums* they are on the *ends*. In *Polypodium*, too, the stipes are jointed to the rootstock, while in *Phegopteris*, as in most of our common ferns, they are not. *Phegopteris* is also very closely allied to the wood fern genus, differing principally in the lack of an indusium. In habit, also, the species are much like the wood ferns and it is probable that they will

ultimately be included in this family notwithstanding the absence of the indusium. For our present purpose we shall include them with the other non-indusiate forms.



COMMON
POLYPODY.
Polypodium vulgare.

The Common Polypody.

Wherever there is a shaded ledge of rocks in the northeastern States one is almost sure to find the polypody (*Polypodium vulgare*). There is no question as to choice of location with this sturdy species. All are alike to it, provided there are rocks upon which it can grow. The only preference it has is for the tops and upper shelves of the rocks where the soil is moderately dry. So characteristic is it in such situations that when one sees a fern clad rocky summit from a distance too great to discern the individual fronds he identifies them with confidence as this species.

The fronds of the polypody are thick and leathery and remain green all winter. They grow from a slender, brown-scaly, branching rootstock that creeps at the surface of the soil, and are produced during most of the early summer. They are ordinarily about a foot long with a short slender stipe and narrow pinnatifid or pinnate blade.

The pinnules are linear, usually blunt at the ends, and



PLATE VI. THE COMMON POLYPODY. *Polypodium vulgare*.

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broaden somewhat as they join the rachis. Occasionally they are slightly serrate. It sometimes happens that fronds of this species are mistaken by the novice for those of the Christmas fern which are also pinnate, but the latter may always be distinguished by the eared pinnules.

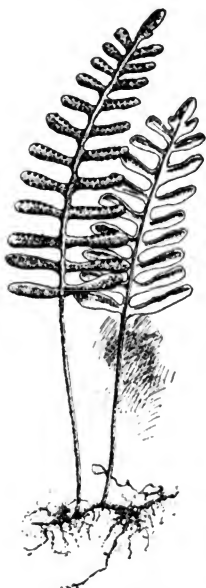
About the middle of June the bright yellow-brown sori begin to appear. They are found on the backs of ordinary fronds in a double row near the margins of the pinnules and mostly in the upper two thirds of the frond. They are round, very regular in arrangement and so large as to be quite conspicuous, looking like little buttons. Except the narrow-leaved chain fern, none of our species produce sori so large. There is no indusium.

Among its common names are adder's fern, golden polypody, golden-locks, moss fern, stone fern, stone brake and wall fern. Most of these are of obvious derivation. It was once considered valuable as a pectoral and, boiled with sugar, was a remedy for the whooping cough. Little, if any, use is made of it at present. According to some authorities, this is the original oak fern although *Phlegopteris Dryopteris* now has the title.

The polypody has numerous varieties but few of them are worthy of special note. The most famous is the Welsh polypody which has a frond much broader than the normal with the pinnæ cut nearly to the midrib into narrow segments making a bipinnatifid frond. It is called the variety *Cambricum*, and is supposed to be always sterile. It was originally found in Wales and has seldom been noted in this country but is likely to occur in any locality where the type is common. The other varieties reported are *angustum* with narrow serrate pinnules, *rotundatum* with short, round-ended pinnules and

cristatum with pinnules variously forked and crested. A form from West Virginia has recently been described as *P. vulgare deceptum*. It differs from the common form in being somewhat larger with narrower, pointed pinnæ. This was earlier considered a mere form and named *biserratum*. Considering the unimportant differences it displays, the earlier view seems the correct one.

In North America the polypody is found from Alabama to the far north and northwestward. Its natural habitat is upon rocks but it is occasionally found upon trees and logs where the atmosphere is moist. In the moister climate of England; it is said to be very commonly found on trees. In our western States, it is rare or absent, but its place is taken by several allied species that much resemble it. It is a tough and hardy species able to endure great extremes of temperature and is found in nearly all parts of the world.



GRAY POLYPODY.
Polypodium incanum.

The Gray Polypody.

The little gray polypody (*Polypodium incanum*) may be termed a straggler into our territory from a warmer region. It is most abundant in the Tropics, where it grows on rocks, trees, walls and even on the roofs of the houses. In the northern part of its range, it is usually found on rocks or about the roots of



BEECH FERN. *Phegopteris polypodioides*.

trees, although in the Gulf States it may be found high upon the trunk or branches.

In appearance it is nearly an exact duplicate of the common species with the same creeping, scaly rootstock and leathery, pinnatifid, or pinnate, fronds. It is, however, rather smaller and further distinguished by having the stipe and under surface of the blade thickly covered with gray, or brownish, peltate scales with darker centres. The upper surface may be slightly scaly, though it is usually smooth. The sori are of medium size and borne near the margins of the pinnules but are seldom noticeable owing to the scales by which they are surrounded. Usually they are so deeply sunk in the blade as to form little bosses on the upper surface.

Since this species grows in situations where moisture is a very uncertain quantity, it has acquired the trick of curling up its fronds when drought comes and remaining in a comatose condition until the next rain, when they are again unrolled and life proceeds as before. During a drouth the fronds have been known to uncurl in a heavy dew.

Among its common names are hoary polypody, scaly polypody, tree fern and resurrection fern. Tree fern is from its habit of growing in the treetops, and resurrection fern refers to its habit of revival after a drought.

This species is found as far north as Virginia, Illinois and Missouri but is not common except in the Gulf States. According to strict priority, this species should have *polypodioides* for its specific name. This being translated would mean, simply, a polypody that is like a polypody! *Incanum* is a name far better known to botanists and is the one generally used.

The Beech Fern.

To find the beech fern (*Phegopteris polypodioides*) in its greatest luxuriance the collector must visit the cliffs and ravines where dripping ledges provide dwelling places to its liking. One soon comes to associate it mentally with the drip and splash of falling water, and the gurgle of small streams.

The rootstock is long and cord-like with many branches and wanders extensively just beneath the surface. In spring, long before the fronds unfurl, the clusters of crosiers covered with small light-coloured scales just peeping above the earth are often noticeable along the rocks, in appearance suggesting the budding horns of the deer. The fronds are produced all summer and owing to the branching and interlacing of the rootstocks are usually found in dense clumps, filling every inch of the ledge on which they are rooted. When young there is a bend where stipe and blade join so that the soft, limp blades hang downward while unfolding like the wings of a newly hatched butterfly.

Mature fronds are often eighteen inches long. The blades do not vary greatly in size but the stipe is long or short as necessity demands, being always of sufficient length to extend the blade out into the light. The stipes commonly grow nearly upright, but the blades make a sharp angle and bend gracefully outward, especially when growing in a niche in the rocks. In shape they are triangular, somewhat longer than broad and once pinnate. The pinnæ are rather long, narrow and acute and cut nearly to the midrib into oblong, blunt segments. In the upper part of the frond, the pinnæ are decurrent



BEECH FERN. *Phegopteris polypodioides*.

on the rachis, forming a lobed border along it, but the lower pinnæ are separate. The lowest pair are lanceolate instead of linear and are brought forward and downward in a striking and characteristic manner. In herbarium specimens, owing to the flattening of the frond, much of this appearance is lost, but when the plant is fresh this feature may almost serve to identify it. The fronds are thin, glandular beneath, and slightly scaly on the rachis and ribs. Sometimes both surfaces are pubescent. The fronds are not evergreen and wither early in autumn.

The sori begin to appear in June. They are borne on both edges of the segments of ordinary fronds and are without indusia as in the true Polypodies. They are quite small and rarely extend to the tips of the segments.

The name of beech fern is said to have been given to this species from a supposition that it is partial to the shade of the beech tree, but a wet rock would seem to be nearer its first requisite, at least with us. It is also called sun fern, perhaps from its growing in exposed places. Many botanists call this *Phegopteris Phegopteris*. When Linnæus named it, he thought it was a *Polypodium* and called it *Polypodium phegopteris*. Later it was taken out of this genus, and placed in a new one created to receive it, and christened *Phegopteris polypodioides*. The question as to which specific name it shall bear depends entirely upon whether or not we should allow it a new specific name when the original one has been taken as the name of the genus. Botanists, generally, dislike the practice of making generic and specific names the same.

This species is found from Virginia, Iowa, and Washington to the far North but is seldom found except in the vicinity of rocks. It also grows in northern Europe

and Asia. It takes readily to cultivation and is excellent for planting on rockeries, each small bit of rootstock soon producing a thrifty colony.

The Broad Beech Fern.

The indiscriminating collector might gather the broad beech fern (*Phegopteris hexagonoptera*) for many seasons and not surmise that he had anything more than the common species, so near alike are they in shape, habit and the cutting of the fronds. The differences, however, are quite apparent when once pointed out and all botanists agree that each is a distinct species.

The broad beech fern is a lover of the deep shady woodlands and cares nothing for rocks. It delights in moist soil, but does not avoid dryish shades and is often to be found in the company of the New York fern. The rootstock is slender and creeping and the fronds are scattered along it at short intervals. The slender, erect, straw-coloured stipes are nearly twice the length of the triangular blades and the latter are pinnate with deeply pinnatifid pinnæ. The blades are usually broader than long and the pinnæ are also broader, approaching a lanceolate form, in this differing from the common beech fern.

The lowest pair of pinnæ are much the largest, broadly lanceolate, narrowed at base with narrow, crenulate-toothed or lobed segments, the longest nearly an inch in length. They may sometimes be deflexed though commonly they are not. The decurrent pinnæ form a conspicuous angled wing along the rachis that usually extends to the lower pair. The sori are borne on the backs of ordinary fronds. They are mostly near the margins of the segments and rather small.

This species averages somewhat larger than the com-



BROAD BEECH FERN. *Phegopteris hexagonoptera*.

mon beech fern and the fronds are more erect. They are also thinner with fewer hairs and scales. The crushed fronds of both species emit a peculiar ferny odour from the minute glands scattered over their blades. This odour differs slightly with the species and one with an acute sense of smell might bring it into use in identifying them.

In the matter of range *hexagonoptera* again shows a difference. It is a southern species, extending from the Gulf of Mexico to Canada. It has not as yet been found in the Old World. The angular wings of the rachis have suggested the specific name and also the common one of six-angled polypody. Specimens intergrading between this and the common beech fern are said to be occasionally found.

The Oak Fern.

Should the collector in crossing a piece of rich moist woods find nestling among the violets, mitreworts and trilliums, a tiny fern with a blade "like three fronds in one" that would pass for a good miniature of the bracken, he will be warranted in concluding that it is the oak fern (*Phegopteris Dryopteris*). The rootstock is like that of the beech fern—slender and creeping—and the fronds are produced all summer. They sometimes attain a height of more than fifteen inches but are usually much shorter. The stipes are very slender and the blade triangular, ternate, and of a delicate shade of yellow-green. At the top of the stipe the blade divides into three nearly equal, triangular, stalked divisions, each of which is pinnate with sessile, deeply pinnatifid, blunt-lobed pinnæ. The middle division of the blade is slightly the largest and the pinnules of the lateral divisions are

longest on the lower side. Even in unfurling, the blades show their ternate character, each division being rolled up separately. These three little green balls on their slender thread-like stalks are exact miniatures of the conventional sign of the pawnbroker. The ultimate segments are often slightly toothed and the rather inconspicuous sori are borne near their margins.

A form of the oak fern, often called the limestone polypody (*Phegopteris Dryopteris Robertiana*) is occasional in Canada and the northwestern United States. It is distinguished by its larger size, glandular fronds, greater rigidity, and in having the lower pinnules on the lateral divisions of the frond scarcely longer than the others. It is frequently considered to be a distinct species and named *P. calcarea*, but the opinion of the majority places it as a variety of the common form.

The oak fern is found from Virginia, Kansas and Colorado to the far North and also in Europe and Asia. The variety is also found in the Old World. The plant is a lover of moist and rocky woods and makes an excellent species for cultivating at the base of the artificial rockery. The initial for this chapter shows a frond of this fern.

The name *Polypodium* is from the Greek and means many feet. By some, this is conjectured to be in allusion to the branching rootstocks of certain species, but it seems quite as likely to refer to the numerous roots which nearly all produce. One writer observes of our common species that "the rhizome when destitute of the fronds has the appearance of some kind of sea polypus." *Phegopteris* means literally beech fern. As the latter genus is defined at present, it contains nearly a hundred species.



"The broad beech fern is a lover of the deep shady woodlands."

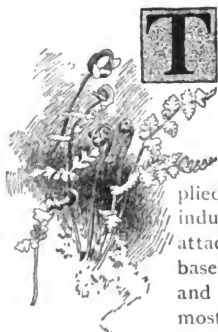


THE BLADDER FERNS.

" Mark ye the ferns that clothe these dripping rocks
The crosier-headed ferns, most fresh and rare,
Their hairlike stalks, though trembling neath the shock
Of falling spraydrops, rooted firmly there.

"What quaint varieties. The leaflets grow
With a metallic lustre all their own ;
And velvet mosses, fostered by the flow
Gain a luxuriance elsewhere all unknown."

THE BLADDER FERNS.

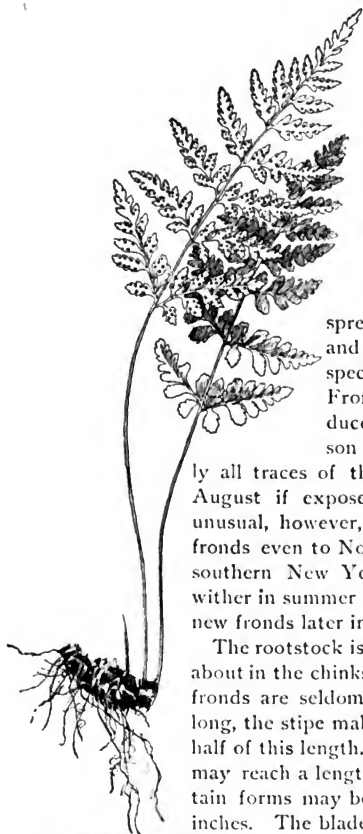


THE bladder fern family comprises less than half a dozen species distributed nearly throughout the world though most abundant in the North Temperate Zone. The generic name, *Cystopteris*, is the Greek for bladder fern and is applied to these species in allusion to the indusium which is hood-shaped and attached to the frond by the broad base on the inferior side of the sorus and arching over it. The species are mostly inhabitants of rocks and are usually plentiful in mountainous regions.

Recently the attempt has been made to change the generic name to *Filix*. This name without doubt was used for the genus before *Cystopteris* was, but the latter has been universally used by botanists for so long that it is very unlikely that *Filix* will ever be accepted.

The Common Bladder Fern.

Shaded rocks in almost any locality are likely to harbour the common bladder fern (*Cystopteris fragilis*). It is fond of a niche in the cliff where its fronds may droop gracefully outward but also grows on the talus of broken rock at their bases and is often found in moist woods. In the extent of its distribution, it yields only to the



COMMON BLADDER FERN.

Cystopteris fragilis.

bracken. It seems equally at home in the Tropics or in lands where snow and ice abound for nearly half the year.

Of all our native ferns, this fragile little species is first to put forth its fronds in spring. They start into growth at the first hint of a warmer season, being often fully spread before those of stouter and what appear to be hardier species have begun to uncoil. Fronds continue to be produced all summer when the season is favourable, but frequently all traces of the plant disappear before August if exposed to drought. It is not unusual, however, to find fresh and green fronds even to November in the latitude of southern New York, and the plants that wither in summer may revive and put forth new fronds later in the year.

The rootstock is rather slender and creeps about in the chinks between the rocks. The fronds are seldom more than fifteen inches long, the stipe making up a little more than half of this length. Mature fronds, however, may reach a length of two feet, while mountain forms may be reduced to four or five inches. The blade is thin, narrowly oblong-



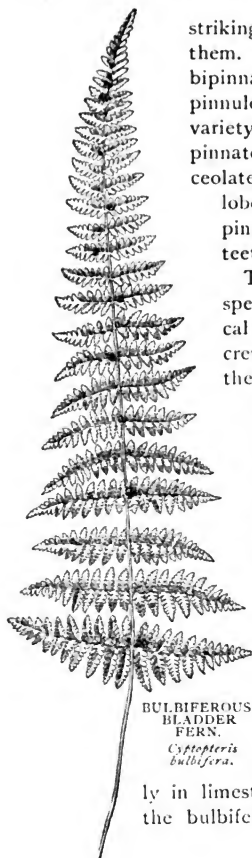
Cystopteris fragilis. A rare form of frond.

ovate, acute and pinnate, the pinnæ rather distant, broadest at base and themselves pinnatifid or again pinnate. The pinnules are narrow, bluntish, lobed or toothed and usually decurrent on the rachis. There is, however, a wide range in the shape and cutting of the fronds. Our illustrations show two interesting forms of American specimens. A pinnule is also shown in the Key to the Genera.

Not only is this species the first to put forth its fronds, but it is one of the earliest to fruit and, unlike other species which fruit early, fertile fronds may be found all summer. Nearly every frond bears sporangia. The sori are rather small and thickly scattered on the lobes of the pinnules. Owing to the early withering of the indusia, they usually appear as if naked. Only in the youngest sori can the indusium be seen to advantage. It is ovate, very thin, and taper pointed. From the shape of the arching indusium, this species was anciently known as the cup fern.

The fronds of this species are very easily confused with those of *Woodsia obtusa*, with which it often grows, and the difficulty in separating them is increased by the evanescent nature of the indusia in both species. In *Cystopteris*, however, a careful search will usually reveal enough shrivelled vestiges of the indusia to make identification sure. In *Woodsia*, too, the pinnæ and pinnules are ordinarily broader and blunter.

In America, the common bladder fern is found from British America to Georgia and Arizona. It is frequently called the brittle bladder fern, a translation of its specific name. The name of white-oak fern has also been given it, though for what reason does not appear. Several varieties have been named but none of them are very



striking and little attention is paid to them. The variety *dentata* has narrow bipinnate fronds with blunt pinnæ and pinnules, the latter toothed. The variety *angustata* has broad, nearly tri-pinnate fronds with acute, rather lanceolate, pinnules with sharply toothed lobes. Variety *laciniata* has the pinnules cut into irregular narrow teeth.

The author once collected this species in the mountains of a tropical island, where it grew in the crevices of a ledge that interrupted the flow of a mountain torrent.

When the rainy season swells the volume of water, all the fronds are washed away, but as soon as it subsides, a new crop is produced. Since there are two rainy seasons in this place the plant seems regularly to produce two sets of fronds each year.

The Bulbiferous Bladder Fern.

Wherever there is a line of shaded, dripping cliffs, especially in limestone regions, one may look for the bulbiferous bladder fern (*Cystopteris*



COMMON BLADDER FERN. *Cystopteris fragilis*.

bulbifera). In such places it grows in great luxuriance and is a singularly decorative species, with long narrow fronds hanging downward over the face of the rock in such profusion as to cover it like a curtain.

Full grown fronds are frequently four feet long. They are on short stipes and twice pinnate, the oblong pinnules toothed, or the lowest deeply lobed. In cutting, the pinnæ have considerable resemblance to those of *C. fragilis*, but the frond as a whole is very different, being widest across the basal pinnæ and tapering outward with regular gradations to the long slender apex. The blades are finely glandular underneath and very fragrant specimens are occasionally reported, the fragrance being doubtless due to these glands.

In appearance the fertile and sterile fronds do not differ materially. The sori are borne in what approximates a double row on each pinnule, a sorus near the base of each tooth. The indusium is not quite so evanescent in this species as in *C. fragilis* though it usually withers when the spores are ripe. In young fruiting fronds it may be very clearly seen. Its apex is truncate.

Although this species produces spores as freely as any, its principal means of propagation is probably by the bulblets which nearly every mature frond bears upon its under surface. These are about the size of a grain of pepper and are borne on one or several of the pinnæ usually in the apical half of the frond. They are in the nature of adventitious buds and consist of two or three cotyledon-like masses enclosing one or more rudimentary fronds. When these come in contact with the soil, they put forth roots and are ready to begin life for themselves. They form new plants much sooner than spores could and the early fronds have less of the juvenile form.

Cystopteris bulbifera ranges from Canada to Tennessee, Arkansas and Wisconsin and is also reported from Alaska. It is rather irregularly distributed, being very common in some localities and entirely absent from others that seem equally favourable to its growth. It is found on many rocks other than limestone and is excellent for the rockery in the fern garden. This species shares with the maidenhair the honour of being first to be sent to the Old World by botanical explorers. In Great Britain it is occasionally known as the berry-bearing fern.

The Mountain Bladder Fern.

The mountain bladder fern (*Cystopteris montana*) is not likely to be found by the eastern collector. It is a rare species within our limits, coming south only as far as Labrador and Northern Canada. It has also been found north of Lake Superior and in the mountains of Colorado. In Northern Europe and Asia it is rather more abundant. It may be distinguished from the other bladder ferns by its almost triangular fronds on long straw-coloured stipes. It is usually about a foot high and grows along woodland streams in deep shade. The blade is thin, three to four times pinnate, the pinnæ much like the frond in shape. The pinnules are deeply toothed and the sori abundant. The indusium is pointed at the free end, and soon withers. Our illustration is from a plant, rather smaller than ordinary, collected in the Cape Nome gold fields.



MOUNTAIN BLADDER FERN. *Cystopteris montana*.

THE CHAIN FERNS.

" We paused beside the pools that lie
Under the forest bough ;
Each seemed as 'twere a little sky
Gulfed in a world below ;
A firmament of purple light
Which in the dark earth lay,
More boundless than the depths of night
And purer than the day ;
In which the lovely forest grew
As in the upper air
More perfect both in shape and hue
Than any spreading there."—SHELLEY.



THE CHAIN FERNS.

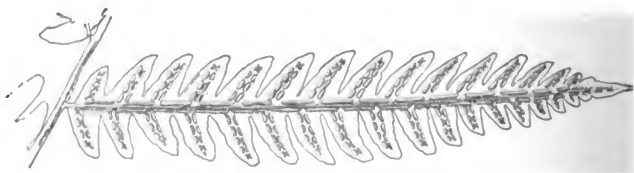
THE chain ferns are most at home in the sandy swamps along the Atlantic seaboard, and unless the collector lives within a short distance of the ocean, he is likely to see comparatively little of them. One species, it is true, is found sparingly in inland swamps throughout most of the northeastern States but it is never plentiful enough to become common. One is likely to always remember the day upon which he first found it in his locality. The family is distinguished from others by the fact that the species bear their sporangia in oblong sori parallel to the midvein, differing in this respect from the *Aspleniums* whose sori are oblique to the midvein. Otherwise the fruit dots are not so very unlike.

The Common Chain Fern.

It is a frequent occurrence for collectors to mistake the fronds of the common chain fern (*Woodwardia Virginica*) for those of the ubiquitous cinnamon fern. When growing in dense clumps they are practically indistinguishable until one is

close to them. Then their separation is very simple and one marvels at nature's versatility in making two species so alike and yet so unlike. Their resemblances are confined entirely to the sterile fronds, their differences are everywhere. The chain fern fruits on the backs of the fronds; the cinnamon fern in a club-shaped spike: the one has a slender rootstock and the fronds rise singly; in the other the rootstock is thick and the fronds grow in crowns. Even the beginner, therefore, has no excuse for confusing them.

The rootstock of the chain fern is about a quarter of an inch in diameter. It creeps extensively in the mud



Woodwardia Virginica. A fruiting pinna.

and ooze of its boggy haunts and sends up its fronds at intervals all summer. These often reach a height of five feet with stipes nearly as long as the blades. The latter are oblong-ovate and pinnate with oblong-lanceolate, acute pinnæ cut three-fourths of the way to the midrib into slightly falcate, obscurely crenate, bluntish pinnules. Although rather thick in texture, they do not survive the winter. There is no perceptible difference in the form of fertile and sterile fronds. The oblong sori are borne on the apical portion, one series in a double row, near to and parallel with the midvein of each



COMMON CHAIN FERN. *Woodwardia Virginica*.

pinnule, and another series of larger sori parallel with the midribs of the pinnæ. They appear as if partly sunk in the tissues of the frond and are covered with a leathery indusium as with a lid. It does not require a very lively imagination to see in the oblong sori placed end to end a resemblance to the links in a chain and the common name is therefore quite appropriate. From its delight in mud and water, it is sometimes called the bog fern. This species is also illustrated in the Key to the Genera.

The chain fern is found from southern Canada to Florida, Louisiana and Michigan and also in Bermuda. It is frequently found growing in several inches of water near the coast where it is often so abundant as to almost fill the swamp, like a field of grain. Inland it is likely to be found in sphagnum swamps among Pogonias, pitcher-plants and other semi-aquatic vegetation. According to Eaton, the fronds may face in any direction in bushy swamps, but when they are exposed to the sun, all face toward the south. It is an excellent species for cultivating on the borders of artificial lakes in the fern garden. On the western coast of America, there is a tall and robust species—*W. radicans*—which is much like ours in general appearance, but is darker green in colour. This is the only western species and is widely distributed in other parts of the world.

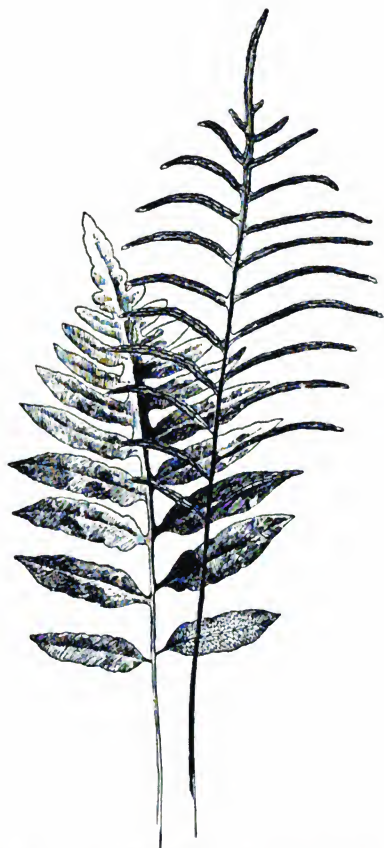
The Narrow-Leaved Chain Fern.

Like its relative, the narrow-leaved chain fern (*Woodwardia angustifolia*) has the misfortune to resemble a more plebeian species. This species is the sensitive fern and the resemblance, as in the case of the other, extends

only to the sterile fronds. Since both the sensitive fern and the chain fern fruit late in the year, there is a large part of the season when they are easily confused, especially if the collector has never seen both growing. It is not to be inferred, however, that it is impossible, or even difficult, to separate the species when sterile. When they are in fruit there is, of course, no chance of mistaking them.

The rootstock is quite slender and creeping and the fronds somewhat scattered along it. The sterile are twelve to twenty inches long with slender, straw-coloured stipes and ovate blades cut nearly to the midrib into oblong, acute lobes. Toward the base, the lobes incline to be separate, the part nearest the rachis being rapidly narrowed into a broadly winged stalk. This makes the blade appear pinnate, at least at base, but there is usually a narrow wing of membrane connecting even the lowest division with the rest. All the pinnules are finely serrate on the edges.

In June the taller fertile fronds begin to come up. They are on longer stipes and quite unlike the sterile fronds. Even the stipe is of a different colour, being black and polished, while the blade is distinctly pinnate with long, narrowly-linear, distant pinnules that seem just wide enough to hold the two lines of large, heavy, sunken sori. None of our other ferns have an indusium so thick and corky, and perhaps for this reason the fertile fronds are much heavier than the sterile. Long after its usefulness has departed, this indusium remains attached to the frond. There are many curious gradations between fertile and sterile fronds both in the shape of the pinnules and in fruitfulness. In the northern part of its range, at least, this species is not evergreen



NARROW-LEAVED CHAIN FERN. *Woodwardia angustifolia*.
Fertile and Sterile Fronds.

but the fronds are among the last to yield to the frost. The fertile, although apparently dead, remain erect for a great part of the winter and it is probable that many of the spores are not released until spring.

This species is found along the Atlantic seaboard from Maine to Florida. Inland it is reported from stations in Arkansas, Tennessee and Michigan, but if it occurs at points between, the fact has not been noted. Within the limits marked by these stations, it is not improbable that more localities for it will be found. Apparently it does not grow in salt marshes although it loves their vicinity. It is most frequently found in springy places in the twilight of pine and cedar groves. I have found it neighbouring the little *Schizæa* in New Jersey, and on Long Island its usual companion is *Aspidium simulatum*. It is frequently called *Woodwardia areolata* in the books, in reference to the interesting series of aureolæ formed by the veins of the sterile pinules.

The genus was named in honour of Thomas Woodward, an English botanist. There are about six species, mostly confined to the North Temperate zone.



PLATE VIII. THE BULBIFEROUS BLADDER FERN *Cystopteris bulbifera*.

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THE BOULDER FERN.

op

Dicksonia groweth in thickets deep,
Where the grouse and the rabbit hide ;
But she loveth best the boulder rock
On the desolate mountain side.

And there, though shaken by wind and storm,
The glint of her fronds is seen,
As she wreathes about the lichened stone
A circle of delicate green.

Fitted by Nature's loving hand
To dwell in the fairest bowers,
She has grace and beauty in every line
And the fragrance of the flowers.

But oh, she loveth the free wilds best
And the cold, gray boulder's side
And there, adorning the rugged steeps,
Forever she will abide.

THE BOULDER FERN.

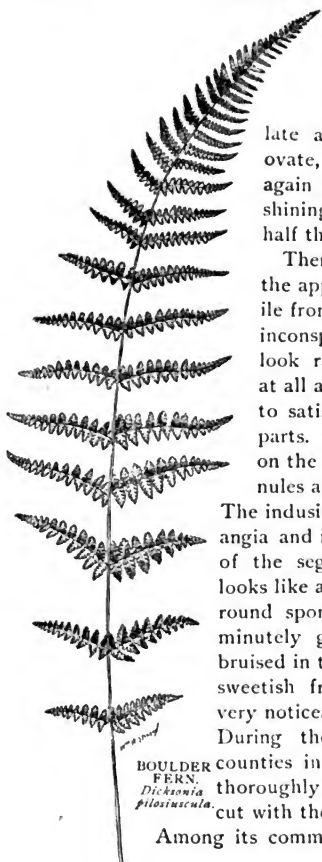


THE boulder fern (*Dicksonia pilosiuscula*) is one of the most beautiful and decorative species of our entire fern flora. Whether growing in clumps in our lowland woods or spreading over large areas in mountain pastures and thickets, its shimmering fronds are sure to catch the eye.

In many uplands the scenery cannot be properly mentioned without taking this fern into account. Those who visit such places about midsummer will scarcely forget the picture formed by the broad gray-green fields in which every boulder and rocky outcrop is outlined by the brighter green of its fronds. Its predilection for rocky fields is very marked. It seems never to grow more thriftily than when clustering in little colonies about some half buried rock fragment. By this trait, alone, one can often identify the fern with certainty at distances of half a dozen miles or more.

The rootstock creeps extensively near the surface of the earth and frequently branches. Fronds are produced all summer and form dense, tangled clumps. The stipe often gives off a runner near its junction with the rootstock and this also produces fronds, being in fact a sort of secondary rootstock. In strong plants the blade is often twenty-five inches or more in length and ten inches wide at the base from whence it gradually tapers to the apex.

THE BOULDER FERN.



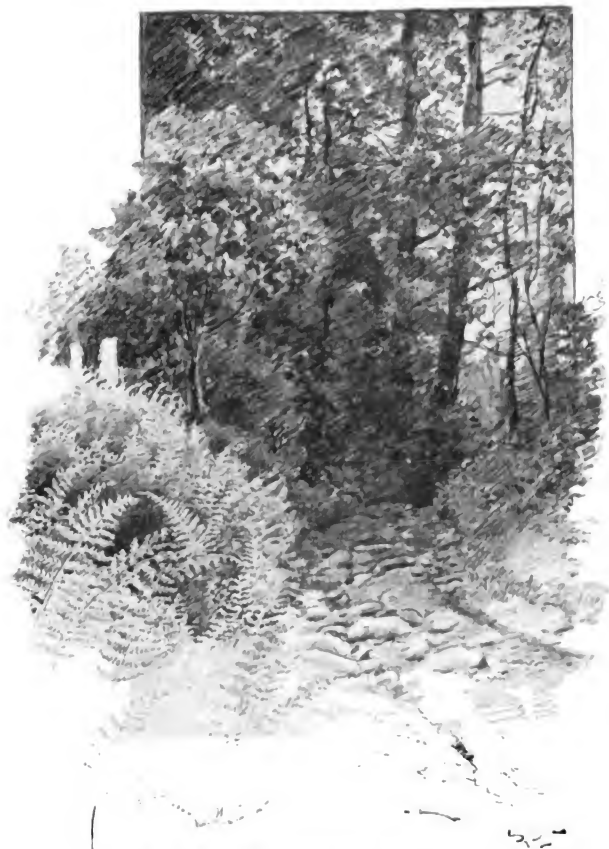
BOULDER
FERN.
Dicksonia
pilosiuscula.

Occasionally it is slightly narrowed below. It is twice pinnate, the primary pinnæ being oblong-lanceolate and the secondary oblong-ovate, deeply lobed and the lobes again toothed. The stipes are a shining chestnut-brown and about half the length of the fronds.

There is not much difference in the appearance of fertile and sterile fronds; indeed the sori are so inconspicuous that one has to look rather closely to see them at all and a magnifier is required to satisfactorily make out their parts. They are mostly situated on the outer margins of the pinnales at the base of the segments.

The indusium is fixed under the sporangia and is held by a reflexed tooth of the segment. Under a lens it looks like a tiny green cup filled with round spore-cases. The fronds are minutely glandular-hairy and when bruised in the hand give off a strong, sweetish fragrance. The odour is very noticeable in the drying plants. During the haying season, whole counties in eastern Pennsylvania are thoroughly perfumed by the fronds cut with the hay.

Among its common names are fine-haired

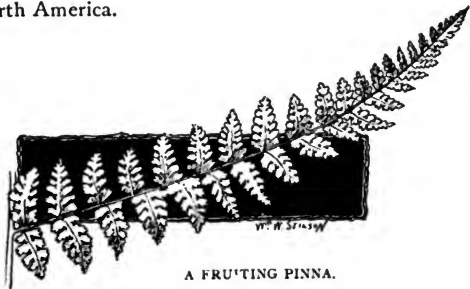


BOULDER FERN. *Dicksonia pilosiuscula*.

mountain fern, hairy *Dicksonia*, gossamer fern and hay-scented fern. All but the last have reference to the delicate structure and handsome cutting of the fronds. To call this the hay-scented fern is certainly to "damn with faint praise."

The boulder fern is found from Canada to Alabama and Minnesota. It is seldom entirely missing in any locality in the northeastern part of its range, but one must visit the stony uplands to see it at its best. It is an excellent species for cultivation in the fernery but the farmer has no desire for its presence in his fields. Cattle will not eat it and it is almost impossible to eradicate from stony soil.

Some botanists assert that our plant and the tree-like species in other parts of the world are not of close enough kinship to be placed in the same genus. They would therefore call our species a *Dennstædtia* reserving the name *Dicksonia* for the arborescent species. The genus *Dicksonia* was named for James Dickson an English botanist. There are about fifty species in the world, twenty of which would be placed in *Dennstædtia* if that genus were recognised. There is but a single species in North America.



A FRUITING PINNA.

CHEILANTHES AND MAIDENHAIR.

" It is a quiet glen, as you may see,
Shut in from all intrusion by the trees
That spread their giant branches, broad and free,
The silent growth of many centuries ;
And makes a hallowed time for hapless moods,
A Sabbath of the woods.

* * * * *

" And still the waters trickling at my feet
Wind on their way with gentlest melody,
Yielding sweet music, which the leaves repeat
Above them to the gay breeze gliding by ;
Yet not so rudely as to send one sound
Through the thick copse around."—SIMMS.

CHEILANTHES AND MAIDENHAIR.



AT first glance the maidenhair fern seems to have very little in common with the various species of *Cheilanthes*, but the way in which they all fruit brings them very close together in the opinion of botanists. Both genera belong to the tribe of which the bracken is a prominent member and, like the species in that genus, bear their sori close to the margins of the pinnules. But here the likeness ends, for there are many patterns after which marginal sori may be arranged. In the bracken the fruit is in long lines and covered with linear indusia; in the maidenhair it is under a reflexed tooth of the pinnule; while in *Cheilanthes* the edges of the pinnules simply curl over the fruit, and scarcely form an indusium at all.

Cheilanthes Vestita.

This interesting little species is rather southern in its distribution, beginning to be rare north of Maryland. It once grew in what is now the northern part of New York City and this is generally supposed to be the fern's northern limit, but a station still further north has been known to a few botanists since 1892 when the plant was discovered near New Haven, Connecticut. This is its northeastern limit, so far as known.

Cheilanthes vestita is a conspicuous example of a rock-loving fern that is not partial to limestone. It shows a strong preference for igneous rock. At the New Haven station it is described as growing in the crevices of a basaltic cliff and in northern New Jersey it is most frequently found on gneiss ledges.

Superficially it has a decided resemblance to *Woodsia Ilvensis* and is not infrequently collected for it. Its fronds are about the same size and shape, are hairy, and the plant has the same fondness for growing in dense little clumps on exposed rocky crests. The species are not difficult to distinguish between, when one has both in hand; the difficulty comes when one collects a single species and would be sure which it is. When other signs fail, *Cheilanthes* may be known for a certainty by its lack of a joint in the stipe. The fronds are also somewhat slenderer, and the pinnules narrower and further apart.

The plant has a short, creeping root-stock covered with hairlike brownish scales, and shows its southern nature by producing fronds until late autumn as if there were no such things as frost and snow. Even in the north, it appears to be evergreen. The fronds are usually from six to eight inches long, on short stipes and narrowly lanceolate in outline. They are twice pinnate, the primary pinnae about ovate,



Cheilanthes vestita.

and the secondary oblong and deeply lobed. Both sides are invested with long whitish hairs which are most abundant upon the under surface. The fronds are dark grayish-green, and the stipe and rachis are dark chestnut-brown and covered with tiny hairlike scales.

The sori are very small and are borne on the lobes of the pinnules whose tips roll over them in little pocket-like indusia. These are always green and have faint likeness to the indusia of other ferns. In old fronds the confluent sori push out from the indusia and cover a large part of the pinnules. In the Key to the Genera, a fruiting pinnule of this species is shown.

Cheilanthes vestita is found southward to Georgia and Texas, and westward to Kansas. It is probably not an abundant species in any locality but where there are exposed cliffs of igneous rock there is always the possibility of finding it. The name of hairy lip-fern, by which this species is frequently mentioned in the books, is rarely used in speaking of it. Recently the specific name *lanosa* has been given this species. Both names have reference to the hairy fronds, and all that has been gained by the change is the addition of another scientific name to perplex the beginner and the satisfying of certain demands for priority. Our illustration is from specimens collected by the author at Milburn, N. J.

Cheilanthes Tomentosa.

It is usually difficult for the young collector to identify the species of *Cheilanthes*. Some will consider them fully as difficult as the wood ferns. *Cheilanthes tomentosa*, however, is one that need not be mistaken. It has a general resemblance to *C. vestita*, but is taller, woollier

and three times pinnate. It is also of more southern distribution, extending to Mexico and the West Indies and barely reaching Virginia and Missouri on the north. Like most of its relatives it loves dry and exposed situations and is often found in places where it does not receive a drop of water for weeks or even months.

The fronds are rather long and narrow, and dull green in colour. The primary and secondary pinnæ vary from ovate to lanceolate and are usually broadest at base. The ultimate pinnules are very small and roundish in outline like little green beads. The terminal segments are about twice as large as the others. The stipe is chestnut-brown but the colour is hidden under the dense coat of hairs. The sori are marginal and arranged in such a way as to appear to form a continuous line on the edges of each pinnule. In youth the edges are flattened over them in a pale green indusium, but later they push from under it and may be seen dividing the margin from the tuft of tomentum in the centre of each pinnule. From its coat of tomentum, this species is sometimes called, in the books, the woolly lip-fern.



Cheilanthes tomentosa.

Cheilanthes Lanuginosa.

This species is likely to impress the observer as possibly a diminutive hybrid between *C. vestita* and *C. tomentosa*. The cutting of the fronds is similar to that of *vestita* while the woolly covering of the under surface is like that of *to-*

mentosa. It is easily our smallest *Cheilanthes*. Ordinary specimens are but two inches high, while the tallest do not reach a length of more than six inches. The fronds form dense tangled mats and the rootstocks are so interwoven that it is usually impossible to separate single plants without injuring them.

The blade is about ovate-lanceolate in outline and is twice pinnate with pinnatifid pinnules, or even three times pinnate. It is further distinguished by bearing the lowest pair of pinnæ at some distance from the others. All the pinnules are so crowded that the frond appears to be less divided than it really is. The sori and indusia are similar to those *C. vestita*. In old fronds the wool on the under surface is deep, dark brown and quite conspicuous. A fruiting pinna will be found in the initial illustration for this chapter.



Cheilanthes lanuginosa.

Cheilanthes lanuginosa grows on exposed ledges from Texas and Arizona to Illinois, Minnesota and British Columbia. In part of its range, at least, the species is evergreen. This plant has had its full share of change at the hands of the nomenclaturist. It was long known as *C. lanuginosa*. Later the name of *gracilis* was decided to be the older and was accordingly adopted. Still more recently it has been renamed *C. Feei* in deference to the rule of priority, this last name having been discovered to be still older. Whether this is the final change remains to be seen.

Cheilanthes Alabamensis.

From all the species of *Cheilanthes* within our limits, this species may be distinguished by its smooth blades. The fronds grow to be a foot or more long and are borne on slender, wiry, black stipes. They are lanceolate in outline and about twice pinnate with numerous ovate-lanceolate, short-stalked pinnae. The pinnules are oblong,



Cheilanthes
Alabamensis.

broadest at base, often with an ear-like process on the outer edge, and variously toothed. The indusium is pale, membranous and more or less interrupted by the tothing of the fronds. The species grows on rocks from Illinois and Virginia to Alabama and Arizona.

Cheilanthes is named from the Greek and may be translated as lip-fern. Its application is due to the lip-like indusia of some species. There are fifty or more members of the genus in the warmer parts of the world.

The Maidenhair Fern.

The maidenhair fern (*Adiantum pedatum*) is one of the few species with which those who make no pretense to botanical knowledge are usually acquainted. Because of its delicate beauty it is much sought by those who delight in woodland rambles, while its peculiar shape and manner of growth, so unlike that of

other ferns, prevent its being easily forgotten. There is perhaps, no other fern family so sharply distinguished as the one to which the maidenhair belongs. The botanist recognises its members at a glance without looking at the fruit, so characteristic is the cutting of the fronds. Of late years the exotic species have come into great favour for decorations and no florist considers his stock complete without them. Since he is accustomed to call them by the generic name, the word *Adiantum* is beginning to have more meaning to the general public than most generic fern names.

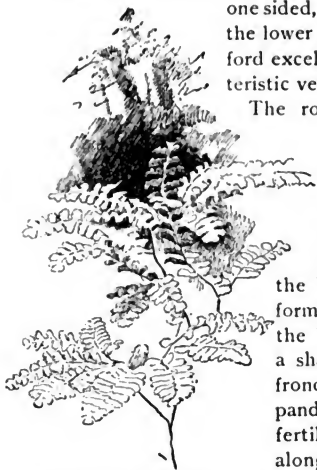


YOUNG FRONDS.

Soon after vegetation starts in spring, the slender crosiers of the maidenhair begin to appear on moist shaded slopes and in low woods. Before they push up, they are protected by many brown, hairlike scales and when uncoiling usually have a few scattered, light-coloured ones along the stipe. At first the stipes are covered with a bluish bloom and the immature pinnæ are of a dull red colour, imparting a not very pleasing lurid hue to the underwoods. At maturity stipe and rachis are smooth, dark and shining—among the handsomest of their kind.

At the summit the stipe divides into two parts, each of which makes a sort of half circle away from the other and nearly at right angles to the direction of the stipe. The pinnæ grow from the upper or outer sides of what may thus be called the two rachids. The pair nearest the forks are the largest, often a foot long and two inches wide, and the others gradually decrease in size making the outline of the whole frond nearly circular. The

pinnæ are broadest about the middle and are again pinnate, with a large number of alternating, slender-stalked, lobed or toothed pinnules, which are peculiar for being one sided, the "midrib" running along the lower margin. These pinnules afford excellent examples of the characteristic veining of the fern tribe.



MAIDENHAIR FERN.
Adiantum pedatum.

The rootstock is found just at the surface of the earth. It is slender, widely creeping and branches freely, giving off numerous black, wiry roots. Fresh fronds are produced all summer and the little colonies of the plants form light, open clumps. Where the blade joins the stipe, there is a sharp bend which causes the frond to hang downward until expanded. Nearly every frond is fertile. The sori are scattered along the outer margins and are covered with a rather conspicuous gray indusium formed by the reflexed and altered segments of the pinnules.

It is said that this species and *Cystopteris bulbifera* were the first American ferns to be taken to England. Until the time of Linnæus it was known as *Adiantum Canadense*. The present specific name is said to be derived from the branching rootstock, but another derivation is given in an old English book which speaks of our plant as the "foot-shaped Canadian maiden hair." Some of the pinnules are certainly not very unlike the



"On moist shaded slopes and in low woods."

human foot in outline. The name of maidenhair was originally applied to *Adiantum Capillus-Veneris* and is said to be in allusion to the slender black stalks. Some, however, would derive the name from the colour and appearance of the roots.

Our plant has some repute as a pectoral and Kalm is authority for the statement that the Indians of eastern America commonly used it in all cases of difficult breathing. The fronds have also been much used as an ingredient in "Syrup of Capillare," for compounding which the following recipe is given.

Maidenhair Leaves,	5 oz.
Liquorice root, peeled, 2 "	
Boiling water,	5 pints.
Let stand six hours and then add	
Loaf sugar,	13 lbs.
Orange water,	1 pint.

The maidenhair is found from Canada to the northern portions of the Gulf States and as far west as Arkansas. It is also found in Utah, California and northward near the coast to Alaska, and again appears in eastern Asia. In British Columbia a form is found with deeply cleft, longer stalked and more erect pinnules. It is not very well known and further study



♂ FRUITING PINNULE.

may result in its being made a separate species. At present it is called the variety *rangiferinum*. Our plant takes readily to cultivation and may be propagated without any difficulty. If the branches of the rootstock are separated and planted by themselves, they will soon form strong clumps.

The Venus-hair Fern.

The Venus-hair fern (*Adiantum Capillus-Veneris*) encircles the world in the Tropics and in both Hemispheres spreads toward the Poles as far as it finds suitable dwelling places. In the Old World it extends to Great Britain and in North America to Virginia, Kentucky, Missouri, Utah and California. It delights in moist and sheltered situations and in the northern parts of its range should be looked for in ravines.



VENUS-HAIR FERN.
Adiantum Capillus-Veneris.

It may be distinguished from the common maidenhair by its dark, wiry undivided rachis and fan-shaped, drooping pinnules on exceedingly slender black stalks. The rachis gives off alternate branches and the pinnules are also arranged alternately. The blade is usually twice pinnate below and simply pinnate above and the pinnules are not one sided as in many species of *Adiantum*. Their outer edges are rounded, rather deeply notched and serrate. There is great variation in the form of both pinnules and fronds. When the pinnules die, they

drop from the rachis which remains erect for some time longer. Nearly every frond is fertile. The sori scarcely differ from those of *A. pedatum*. Specimens have been reported in which the spores gave rise to young plants while still on the frond.

All sorts of medicinal virtues were once ascribed to this plant, but at present, little or no use is made of it. It is slightly astringent and is the species originally used in making "Syrup of Capillare."

In 1898 a large colony of this fern was found along a stream fed by hot springs, in the Black Hills of South Dakota. Its occurrence in this place, at so great a distance beyond its ordinary limits, is no doubt to be explained by the fact that the warmth of the water modifies the temperature of the region in winter rendering it similar to that which prevails in the stations further south. The species has also been reported from New York and Pennsylvania, but the evidence is hardly convincing.

The name *Adiantum* is from two Greek words meaning without wet, and has reference to the fact that the fronds of most of the species are so smooth that water runs off without wetting them. There are about seventy-five species, mostly in the American Tropics. Some of these are among the handsomest of ferns, and no species in the genus is unattractive.

THE SENSITIVE AND OSTRICH FERNS.

“ And there the full broad river runs,
And many a fount wells fresh and sweet,
To cool thee when the mid-day suns
Have made thee faint beneath their heat.”—BRYANT.

THE SENSITIVE AND OSTRICH FERNS.



BOTANISTS have always been divided in opinion as to whether the ostrich and sensitive ferns should be considered members of the same family. They have an unmistakable likeness and must be considered as cousins if not of nearer kinship. The principal differences are that one has a running rootstock, scattered fronds and anastomosing veins, while the other has an upright rootstock, fronds in crowns and free veins. The first is the type of *Onoclea*, the second of *Struthiopteris*. *Onoclea* is named from two Greek words meaning a vessel and to close, in allusion to the berry-like, fruiting pinnules. *Struthiopteris* is also from the Greek and may be literally translated as ostrich fern. As modern botanists view them, there is but a single species of *Onoclea* in the world, and but two of *Struthiopteris*.

The Sensitive Fern.

The sensitive fern (*Onoclea sensibilis*) is one of our most abundant species. Wherever the soil is moist, in woodland, thicket and the open field, it is likely to occur,

while it forms a more or less continuous border to all our streams and ponds. Very few of those who pass it or wade through it have any idea that it is a fern, for its broad coarse fronds are far from the common conception of fern leaves.

The rootstock is as thick as a pencil and creeps just at the surface of the earth, frequently branching. In addition to the fronds, it produces, here and there, appendages exactly like the bases of the stipes but which end in a point and never become more than two or three inches long. The fronds are produced all summer but the young crosiers are most noticeable early in the year when they push up in such numbers in all low grounds as to make their tawny pink hue the prevailing one for some days. Seen in the mass, the young fronds can scarcely be called beautiful, but a single one taken just as the pinnules are unrolling and viewed from base to apex in the plane of the blade will show such a succession of scrolls and arches as to suggest a miniature of the interior of some old cathedral.

When the sterile fronds are fully spread they are, to most eyes, coarse and ugly. They are ovate in outline, pinnate below and pinnatifid toward the apex. The pinnules are linear-lanceolate, the upper nearly entire, the lower sinuate-toothed or lobed. The fronds are borne on long stipes and often reach a height of more than two feet. About midsummer the fertile fronds appear. They are shorter than the sterile, bipinnate, and the pinnules resemble rows of little green berries strung along the midribs. Many suppose each berry to be a sort of sporecase like those of the rattlesnake fern, but it is easy to see that they are simply closely rolled pinnules enclosing the sori. Each sorus has an indusium but it



SENSITIVE FERN. *Onoclea sensibilis*.
Young Fronds.

is so very fugacious that it is seldom seen by any save the inquisitive scientist. It is hood-shaped, somewhat like that of *Cystopteris*, and attached to the frond on the inferior side of the "blackberry-like" sorus. It can be found only in the youngest fronds. Part of a fertile frond is shown in the Key.

At the approach of cold weather, the sterile fronds wither but the fertile remain erect all winter. The latter are most noticeable against a background of snow-clad earth, but would never be taken for a fern by the ordinary rambler. The berries remain tightly closed through the winter and the sporecases commonly do not release their spores until spring. Even then the fronds do not fall. It is easy to find plants with fertile fronds of three seasons still in place. The spores promptly germinate in spring.

The origin of the common name is involved in some obscurity, and several ingenious theories have been advanced to account for it. One suggests that it has reference to the fact that the frond withers so soon after being cut; another that it is because the fronds are sensitive to autumn frosts. Eaton says that the young fronds are occasionally cut down by late spring frosts, but this is not a common occurrence. There is still another theory which accounts for the name by the assumption that the growing fronds wither if touched by the human hand, but withstand the touch of other bodies. The German botanist, Sprengel, is quoted as having proved this by numerous experiments, and in Britten's "European Ferns" we read that "the barren fronds are so thin and delicate in texture that they will wither, even when growing, if drawn once or twice through the hand." Those who are acquainted with our plant, will no doubt wonder

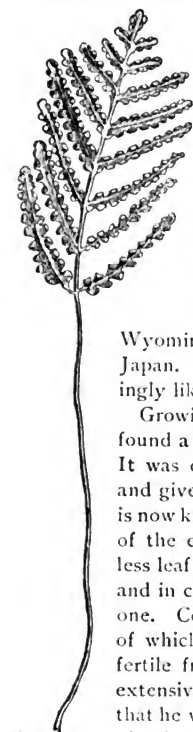
where this author obtained his specimens. In the fourth edition of Amos Eaton's botany published in 1834, the

author says: "The leaflets slowly approach each other on squeezing the stem in the hand." Many observers will testify that they cannot be made to do so in these degenerate days. The species is sometimes called oak fern or oak-leaved fern. In some ancient botanical works it is mentioned as "dragon's bridges," though for what reason, no one seems to know.

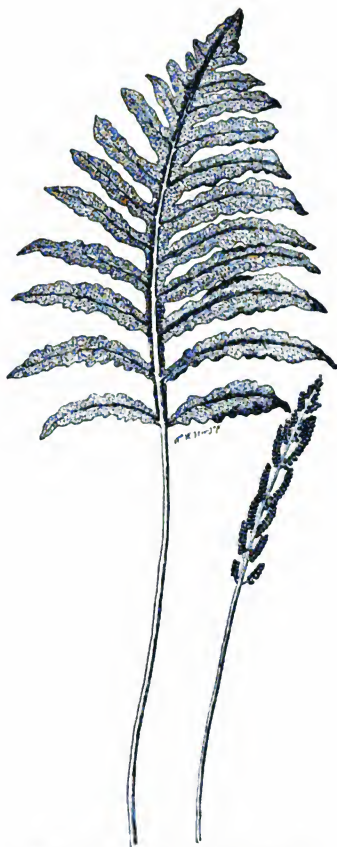
The sensitive fern is abundant in nearly all the territory from Canada to the Gulf of Mexico and west to the Mississippi. Scattered colonies occur as far west as

Wyoming, and the same species is again noticed in Japan. In Montana, this species, or one exceedingly like it, has been found as a fossil.

Growing with normal fronds, there is often found a form half-way between fertile and sterile. It was once considered to be a permanent type and given the varietal name of *obtusilobata*, but it is now known to be due merely to the destruction of the early sterile fronds. It usually contains less leaf surface than the ordinary sterile frond and in cutting resembles the twice pinnate fertile one. Commonly it bears a few abortive sori, all of which show it to be a partially transformed fertile frond. Prof. Geo. F. Atkinson, who made extensive experiments with this plant, found that he was able to produce the variety at will, by simply cutting off the early sterile fronds.



Oncoclea sensibilis
obtusilobata.



SENSITIVE FERN. *Onoclea sensibilis*.
Fertile and Sterile Fronds.

The Ostrich Fern.

The ostrich fern (*Struthiopteris Germanica*) is the tallest of eastern American ferns and by many regarded as the handsomest. It is at its best in the wet, sandy soil of a half-shaded island or river shore and in such situations puts up magnificent crowns of fronds that often reach a length of seven feet. In the northern United States, there are many jungle-like thickets of this species in which a man of ordinary height may stand and be completely hidden.

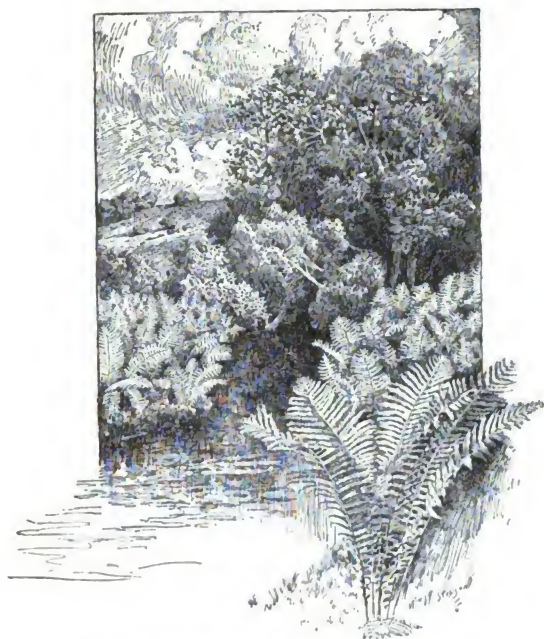
The rootstock is thick and erect, usually projecting slightly above the surface. During winter the croziers are covered with an abundance of coarse brown scales, but when they begin to grow these are soon thrown off. They develop very rapidly, often lengthening six inches in a day. The fronds rise in circular crowns and spread gracefully outward in shuttlecock fashion after the manner of the cinnamon fern, which this species, in general appearance, greatly resembles. They are oblanceolate, broadest toward the apex and gradually reduced downward to the short stipes. They are pinnate with very many pairs of long narrow pinnae which are again cut nearly to the midrib into close, short, slightly falcate, acute or obtuse lobes. The lowest pinnae are often less than an inch long, while the longest often exceed eight inches.

The early fronds are always sterile. About July the fertile fronds come up in their midst. They are quite short, stiff and simply pinnate, and look so much like stunted sterile fronds as frequently to deceive the amateur cultivator. The fruiting pinnae are necklace-like

in shape, and upon examination prove to be much like the sterile pinnae, except that each edge is tightly rolled over to the midrib, forming two parallel chambers in which the sori are enclosed. Cut across the end, a pinna reminds one of two tiny gun-barrels and the likeness is heightened by the black, powdery spores that sift out. The books are either silent in regard to the indusium, or assert that this species has none, but according to Eaton there is a scale-like indusium at the base of each sorus. This is only to be seen in very young fronds and resembles that of *Onoclea*. Fronds intermediate between fertile and sterile are occasionally found, and may be produced artificially by cutting off the sterile fronds early in the year. The sterile fronds die in autumn but the fertile, like those of the sensitive fern, survive the winter, although to all appearances dead. The spores are not released until spring, when they readily germinate. Since they contain chlorophyll they are not able to retain their vitality for much longer than a year.

When the ostrich fern gains a foothold in a locality, it spreads rapidly by means of stolons. These are developed from adventitious buds on the rootstock at the bases of the old fronds. Large numbers of them remain dormant but a few usually develop into slender runners that wander about in the earth and finally throw up a new crown of fronds from the tip at some distance from the parent plant.

The common name is due to an imagined likeness of the fronds to an ostrich feather. It is sometimes known as ostrich-feather fern. In Europe it has been called two-ranked fern because its fertile fronds have two rows of fruiting pinnules. The name of shuttlecock fern is



"In the wet, sandy soil of a half-shaded island."

most appropriate, but is seldom heard. A section of the fertile frond is shown in the Key.

The ostrich fern is a lover of the North. In America its southern limit is the state of Virginia. From thence it ranges to Alaska becoming common in most of the northern states. In Europe it frequently grows within the Arctic Circle. It may occasionally be found in swamps, but is most likely to grow along the larger streams or on the borders of lakes and ponds. It is highly valued for decorative planting out of doors. In some of the northern cities, venders go about the streets in spring with wagon loads of it, which they are able to dispose of at good prices.

In the general mutation of fern names this species has not escaped. If placed with *Onoclea*, as it frequently has been, it would be *O. Struthiopteris*. Recent writers incline to place it in still another genus as *Matteuccia Struthiopteris*. The American plant differs slightly from that of Europe, having taller fronds and longer stipes, and is frequently called the variety *Pennsylvanica*, especially in the Old World. If the name *Matteuccia* should ultimately prevail, it is not unlikely that our plant may yet be known as *Matteuccia Struthiopteris Pennsylvanica*. The genus has been known as *Struthiopteris* for so long, however, that it will probably remain unchanged.

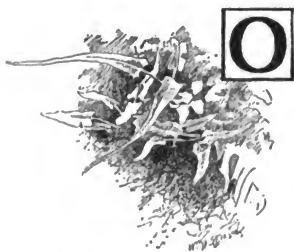


OSTRICH FERN. *Struthiopteris Germanica*.
Fertile and Sterile Fronds.

THE WALKING FERN AND THE
HART'S-TONGUE.

"The thick and rich-looking yet leathery texture of the fronds of the Hart's-tongue, with their deep and shining green colour, make them look exquisitely cool and refreshing, rising up out of the dark hedge-bank as they do, in thick and clustering tufts—sometimes almost erect, at other times gracefully bending backward their shining leathery tips. . . . You will find it growing almost everywhere in Devonshire : on the tops and at the sides of walls ; hanging from old ruins ; growing out from the sides of cliffs and deserted quarries ; and dropping down its long green fronds into the cool and limpid water of roadside wells hewn out of the rock."—FRANCIS.

THE WALKING FERN AND HART'S-TONGUE.



ONE of the good points about the study of ferns is that the subject can never be quite exhausted. There is always something more to be learned or a species yet undiscovered in the locality to search for. Some plants have the faculty of eluding one for years and then appearing in some out-of-the-way nook, while others must be made the objects of special expeditions if one would obtain them. In the latter category may be placed the two plants to be discussed in this chapter. In addition to being uncommon or rare, their peculiar forms make them easily overlooked unless the collector has once seen them growing.

The Walking Fern.

The very name of the walking fern (*Camptosorus rhizophyllus*) sounds sufficiently attractive to arouse interest in those who ordinarily are not fern collectors. Comparatively few, however, have seen it growing and the majority are inclined to hold curious ideas regarding it. One collector told the writer that he fully expected to

see the plant moving about, when he went to collect it for the first time.

The odd little fronds, spreading about in circular tufts from a small black rootstock, and seldom rising far above the surface of the mossy rock, present a picture that will linger long in the memory. At base the fronds are heartshaped or eared, and above taper to a long slender tip. Sometimes they may reach a length of fourteen inches, though they perhaps never appear as long to the eye as they really are, owing to its failure to make proper allowance for the prolonged apex. The sporangia are borne in oblong or linear sori, mostly on the broad basal portion of the frond. Some of these are parallel to the midrib and others oblique to it. Those near the midrib are usually single but the outer ones are likely to be double or to connect with others at the ends, forming curious patterns, apparently without order, but which upon examination are found to follow the veins. The early fronds are short, blunt-ended and usually do not bear sori, being devoted to purely vegetative functions.

The most interesting characteristic of this species is found in the way in which its fronds arch over until they touch the earth where they root and form new plants. Some of our other ferns occasionally produce plants in this way, but in this species it is a settled habit. The new plants grow up, repeating the process of walking and soon the original plant is surrounded by quite a colony of its offspring produced without the intervention of spores. The connections between them are slow to die, and it is not unusual to find three or four generations linked together. Occasionally, also, the basal lobes are elongated like the tips and may produce plants in the same way.

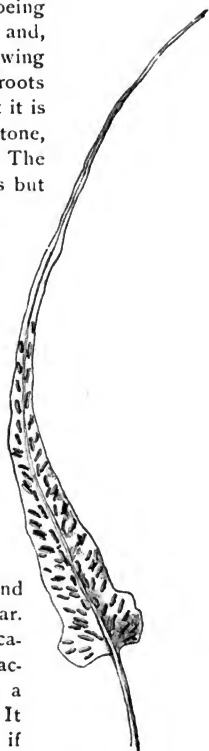
The walking fern ranges from the far north to Georgia



"It carpets the face of the gray rock with its interlacing fronds."

and Kansas. It was once regarded as being closely restricted to limestone rocks, and, indeed, shows a preference for them, growing where the soil is soft and thin and its roots can come in contact with the stone; but it is now known to grow also upon sandstone, shale, gneiss, quartzite and granite. The books unite in calling it a rare species but this is due more to its local distribution than to any lack of the plants themselves. It certainly is not rare with the rareness of the hart's-tongue or *Asplenium ebenoides* or even the little curly grass. On the dryish ledges of shaded cliffs it frequently spreads a carpet of its interlacing fronds that may be pulled off in large sheets. Its fondness for horizontal shelves and the tops of rocks is especially noticeable. Miss S. F. Price notes in the *Fern Bulletin* that in parts of Kentucky the plant is called wall link.

The leathery, dark green and glossy fronds endure the winter unharmed and last for some time the following year. There is some belief that they may occasionally last through two winters. On account of its interesting features, it is a desirable plant for the fern garden. It will grow and thrive in any garden soil if given deep shade, but it does much better in the chinks of a rockery made of limestone or other calcareous material.



A FRUITING
FROND.

A form called *intermedia* has been described from Iowa. In this the fronds are without ears at base and taper to the stipes, in which characteristic they resemble the Old World species, *C. Sibericus*. This latter inhabits northern Asia and Japan and is the only other species in the genus. The word *Camptosorus* is derived from two Greek words meaning bent and fruit-dot and refers to the lines of crooked sori.

The Hart's-Tongue.

There can be no difference of opinion as to which is the rarest fern in Northeastern America. This distinction is well known to belong to the hart's-tongue (*Scolopendrium vulgare*). So far as known, two limited regions in the United States and two in Canada are the only ones in the Western Hemisphere in which it grows. On the other side of the world, however, it is abundant and Shirley Hibberd includes it among the four commonest species about London.

It was first discovered in America near Syracuse, N. Y., by Frederick Pursh who writes that he found it "In shady woods in the western part of New York, on the plantation of J. Geddes, Esq." It was afterward found in greater abundance at Chittenango Falls and this place is frequently named as the original station, but the recent rediscovery of Pursh's station for it has set the question at rest. At Chittenango Falls, the plants are plentiful, growing on the talus at the base of a limestone cliff, where the atmosphere is constantly moist from the spray of a nearby waterfall.

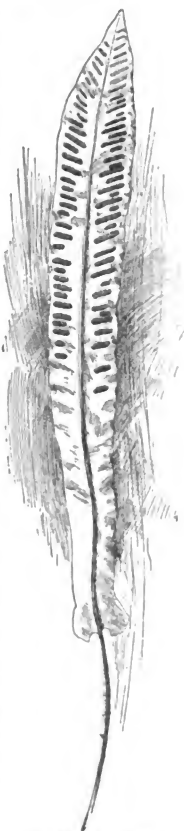
The fronds spread outward in a circular tuft and are about half erect. They are dark, glossy green above, somewhat lighter beneath, and very thick and leathery.

The stipes are short and the entire frond seldom reaches a length of more than twenty inches or a width of two inches. It is narrowest at the eared and heart-shaped base and gradually widens to beyond the middle, and then tapers to the acute apex. The margins are entire but with such an abundance of tissue that they present a ruffled appearance in the living frond. Much of this appearance is lost when it is pressed for the herbarium.

The spores are not ripe until September. They are borne towards the apical half of the frond in long lines reaching nearly from midvein to margin. Occasionally the sori reach quite to the margin and over on the upper side. They are in pairs, one on each side of the vein and opening toward it. The fruit is very abundant and the fertile fronds are noticeably heavier than sterile ones.

This species is noted for the frequency with which it produces forked fronds. It is as if it has exerted its utmost to be fine and delicate like the rest. At Chittenango Falls we found plenty of such fronds without searching for them. One was forked seven times. The fronds also occasionally root at the tip and Lowe mentions a plant found wild in Ireland which had the upper surface scattered over with young plants.

The hart's-tongue has several common



HART'S-TONGUE.
Scelopendrium vulgare.

names. Hound's-tongue and seaweed fern have reference to the shape of the fronds, while caterpillar fern and buttonholes are doubtless in allusion to the appearance of the sori. When the sporangia are just pushing aside the white indusia their likeness to buttonholes is not difficult to imagine. The plant once had some repute as a remedy for burns and eruptions of the skin and was called burnt-weed. Britten says it is known as Christ's hair in the Isle of Guernsey in allusion to the black vascular bundles in the stipe. The plant is mucilaginous to the taste and in France it is said to be infused with milk for the sake of the slight but pleasant flavour which it imparts to it.

The hart's-tongue has been reported from several stations in the vicinity of Syracuse, N. Y., and from one locality in Tennessee. It is also found in New Brunswick and at Owen's Sound in Canada. In the latter locality it is said to be fairly abundant. In the Old World it is found in Europe, the Azores, Japan, etc. The plant is easily cultivated and forms fine clumps which afford a pleasing contrast to the divided foliage of other ferns. Single plants have been known to have as many as thirty fronds at one time. Under cultivation it produces numerous varieties. Nearly a hundred are known. According to Moore, the fleshy bases of the stipes persist for some time after the fronds have perished. If these are cut apart retaining a part of the "rind of the caudex" on each, and planted like root-cuttings, they will soon bud from the cut edges and form new plants. Our illustration was made from specimens collected at Chittenango Falls by the author.

Scolopendrium is from the Greek for centipede, in allusion to the parallel lines of sporangia, which suggest



W. H. C. STONE

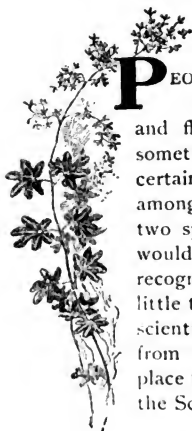
IN THE HAUNTS OF THE HART-STONGUE.

the legs of that animal. There are about half a dozen species. The scientific name of our plant has been frequently changed. It was long known as *Scolopendrium vulgare* or *S. officinarum*; later it was called *S. Scolopendrium*, and still later *Phyllitis Scolopendrium*. Those who are interested in the plant rather than its name will prefer to call it by its best known title, as we have done, until the makers of nomenclature decide upon a name that shall not be changed.

THE CURLY GRASS AND THE
CLIMBING FERN.

“ Here are old trees, tall oaks and gnarled pines,
That stream with gray-green mosses : here the ground
Was never trenched by spade, and flowers spring up
Unsown and die ungathered. It is sweet
To linger here among the flitting birds,
And leaping squirrels, wandering brooks and winds
That shake the leaves, and scatter, as they pass
A fragrance from the cedars, thickly set
With pale blue berries,”—BRYANT.

THE CURLY GRASS AND THE CLIMBING FERN.



PEOPLE who are not fern students can usually distinguish between ferns and flowering plants although they do sometimes include the feathery leaves of certain flowering plants, like yarrow, among the former. In the case of the two species here mentioned, however, it would not be surprising if they did not recognise them as ferns. There is very little that is fern-like in their forms, and scientists, drawing a nice distinction from the structure of their sporangia, place them in a separate family known as the Schizæaceæ.

The Curly Grass.

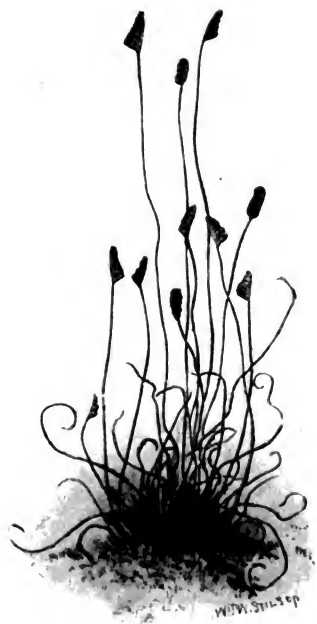
To see the curly grass (*Schizæa pusilla*) in its haunts, one must visit the southern part of New Jersey where it is fairly common on the border of many sandy cranberry bogs. For a long time this small state contained all the known stations for the plant, and it is still the only section in which it is plentiful.

Although never found far from the sea-coast, this is a

plant of the fresh water swamps and bogs. When full grown it seldom attains a height of six inches and the slender fronds present so little surface for the eye to rest upon that it is one of the most difficult of our ferns to distinguish from its surroundings. It is only in mid-summer or later, when the spikes show a glint of brown, or in a mild winter when the absence of vegetation renders the sterile fronds conspicuous, that one can search for the plant with much hope of finding it. Even then one must often get down on hands and knees to see it.

The sterile fronds are an inch or more long and scarcely wider than pencil marks. They are twisted or half coiled in loose open spirals and spread about as if trying to lay hold upon the vegetation near. In July the fertile fronds push up on thread-like stems. They are quite as inconspicuous and have no greater likeness to fern leaves than have the sterile ones. At the top of the stipe are four or more pairs of finger-like pinnæ enclosing the sporangia. The lowest pair are longest and all are set closely together in a little brown spike that resembles a tiny fist. The fruiting fronds remain on the plant during the winter and occasionally until the middle of the following year. Possibly they do not release their spores until spring.

Some time after the curly grass was discovered in New Jersey, a few plants were found in Nova Scotia by Mrs. E. G. Britton and still later, in 1896, specimens were collected in Newfoundland by Rev. Arthur Waghorne. This is not the first record for Newfoundland, however. In the Jardin des Plantes at Paris, are specimens collected long ago by De la Pylaie and labelled Newfoundland, but until the fern was rediscovered there, they were



Schizaea pusilla.

believed to have come from New Jersey and to have been wrongly labelled.

In parts of New Jersey, this plant may be said to be fairly common, and new stations for it are frequently discovered. It delights to grow in wet open places in the midst of sphagnum and cranberry vines, with *Lycopodium Carolinianum*, *L. alopecuroides* and the sundews for companions. Usually there are cedar swamps in the vicinity. When all these plants are present, one may have great hope of finding the fern. New stations for it have been predicted from a distance by means of its companion plants, and the prediction subsequently verified by the finding of specimens. New stations, however, are most frequently found by accident. The one at Tom's River is said to have been discovered by a botanist who, in placing his open press on the ground to put in some plants, found *Schizæa* peeping up between the sides.

Besides the name of curly grass given it from the form of the sterile fronds, it is sometimes called one-sided fern because the fertile pinnæ appear to be all on one side of the rachis. Lawson, in his "Fern Flora of Canada," gives it the fanciful name of Atlantis fern, but this, like most manufactured names, has not come into general use.

At present, Newfoundland and Nova Scotia are the only places outside of New Jersey in which this fern is known to grow, if indeed, it is now found in Nova Scotia at all. The station, which was a small one, is said to have been destroyed by fire. In the vast stretches of country between Newfoundland and New Jersey there are bogs with many variations of soil and temperature, some of which should be suitable to its growth, and it is not unlikely that our plant may yet be found at other

points. It would scarcely surprise botanists to hear that it had been found on Long Island where there are many spots that exactly duplicate its favourite New Jersey bogs.

The name of the genus is from the Greek, meaning to split. It seems unmeaning enough, applied to our species, but the fact that foreign members of the group have fronds that appear as if divided to the midrib with some sharp instrument makes the name very appropriate. There are fifteen species in warmer climes. Our species has the distinction of growing nearer to the Pole than any other member of the family. Our illustration is made from a specimen collected by the author at Forked River, N. J.

The Climbing Fern.

The slender twining fronds of the climbing fern (*Lygodium palmatum*) may seem an anomaly among ferns to American collectors, but in warmer regions climbing ferns are common and are found in several different families. The family to which our plant belongs, however, is the true climbing fern family, for all of its twenty-five or more species are climbing. Indeed, the generic name means flexible and alludes to the scandent stems. One species in the West Indies sometimes reaches a length of thirty or forty feet, having perhaps the longest frond of any living fern.

The fronds of our species seldom exceed a length of three feet. They are scattered on a slender, cordlike rootstock that creeps along just beneath the surface of the earth. The stipe is dark, shining brown and continues through the frond as the rachis. A few inches above the soil, it begins to give off short, alternate



CLIMBING FERN. *Lygodium palmatum*.

branches, each of which is forked with a pair of frondlets at the end. These are about semi-circular in outline, and cut halfway or more toward the base into from five to seven ovate or oblong leaflets. The basal ones are eared on the lower side making each frondlet somewhat heart-shaped at base. In fertile fronds, the frondlets toward the apex are suddenly reduced to a panicle of many short narrow segments, but with a general resemblance in their form to the sterile



A FRUITING PINNA.

ones. On the underside of these segments, there is a double row of alternating, scale-like indusia each covering an egg-shaped sporecase. After the spores are ripe, the fertile portion dies, but the sterile frondlets remain green through the winter and until the young crosiers begin to develop in spring.

In autumn the fronds are offered for sale for decorative purposes in many of our southern and eastern cities, and the great demand for it has nearly caused its extinction in some sections. In Connecticut the legislature once passed a law imposing a penalty upon any person who should uproot or carry away from the land of another, specimens of this fern. This is probably the only fern thus distinguished.

This species is also called creeping fern, snake-tongue fern, Hartford fern and Windsor fern, the last two names referring to localities where it was once common. It ranges from Massachusetts to Florida, mostly near the coast, and has also been found in Kentucky and Tennessee, but not in the intervening territory. It grows in low thickets and on the banks of streams, twining over

weeds and small bushes. Possibly it may be found at a few more stations inland, but it is likely to remain rare in such places. In cultivation it forms a most attractive feature of the fernery, whether out of doors or in the house.

BORDER SPECIES.



"I come from haunts of coot and horn,
I make a sudden sally,
And sparkle out among the fern,
To bicker down a valley."



BORDER SPECIES.

BESIDES the truly representative species of eastern America, there are a few whose centre of distribution is beyond our limits but which stray far enough over the borders to make some mention of them desirable.

The Rock Brake.

One of the most interesting of the border species is the rock brake (*Cryptogramma acrostichoides*) which inhabits the far North. In the East it reaches to Labrador and the country north of Lakes Huron and Superior, but in the West it is found in Colorado and California and extends from thence to the Arctic Circle. It is an inhabitant of rocky places, growing in the chinks between the stones, often in dense patches.

The plants are usually from six to eight inches high. The stipes of the fertile fronds are about twice as long as those of the sterile, so that there are usually two tiers of fronds. Both are ovate-oblong in shape, the sterile rather thin and twice pinnate with ovate pinnæ and toothed or lobed rounded pinnules, while the fertile are three times pinnate, with long, narrow, podlike pinnules, due to the edges being rolled back to the midrib. The sporangia are borne in roundish sori near the margins which are slightly altered to form the indusium.

At maturity the pinnules partly unroll and become more or less flattened. Specimens intergrading between fertile and sterile fronds are sometimes found.

There are but two species of *Cryptogramma* in the world. The second species inhabits the northern and elevated portions of the Eastern Hemisphere. The two are very much alike and our species was formerly considered a variety of the other. A few botanists now incline to add the slender cliff brake to this genus, which shows among other things, that the lines dividing certain genera are very slight indeed. The generic name is in allusion to the way in which the plant fruits. From the appearance of the sterile fronds it is frequently called the parsley fern.

Notholaena dealbata.

Our single representative of the genus *Notholaena* extends no further east than Missouri and Kansas where it grows in the clefts of calcareous rocks. Southward it extends to Texas and Arizona. Beyond its range, westward, there are upwards of a dozen species and of the thirty or more that compose the genus, a large majority are American. In the southwestern part of its range our plant meets another species, *N. nivea*, of which it was once considered to be a variety.

The fronds seldom reach a length of six inches and

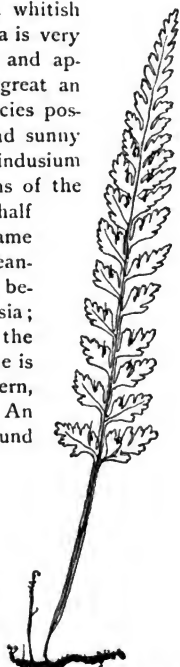


ROCK BRAKE.
Cryptogramma
acrostichoides.

grow in tufts from a small rootstock. They have dark, shining stipes and rachids and are three or four times pinnate. The blades are triangular ovate and the pinnæ ovate and mostly stalked. The ultimate pinnules are very small and covered beneath with a whitish waxy powder. This powder or farina is very common in other species of this group and appears to serve as a protection from too great an evaporation of moisture, since the species possessing it are all inhabitants of dry and sunny places. The sporangia are without indusium and are borne in lines near the margins of the pinnules by which they are commonly half enfolded when young. The generic name *Notholaena* is derived from two words meaning a spurious cloak. By some this is believed to refer to the rudimentary indusia; by others to the woolly covering of the original species. From the generic name is derived the common name of cloak fern, occasionally applied to this species. An illustration of a fruited pinnule will be found in the Key.

The Killarney Fern.

The group to which the Killarney fern (*Trichomanes radicans*) belongs, differs from our common ferns in their manner of fruiting as well as in a few other matters, and botanists have therefore placed them in a separate order as the Hymenophyllaceæ, equal in rank to



KILLARNEY FERN.
Trichomanes radicans.

the polypody, osmunda, adder's-tongue and climbing fern families.

Our species is one of the most widely distributed of its tribe. It is found in the Tropics of both Hemispheres and in many parts of the Temperate Zones. In America it grows from Kentucky to Florida, inhabiting wet rocks. The rootstock is slender, cordlike, covered with dark hairlike scales and often creeps extensively. In the warmer parts of the earth it ascends trees to heights of several feet. There is considerable variation in the fronds from different regions. In specimens from Kentucky and Alabama the blades are long and narrow and an inch or more wide at base, tapering upward to the slender apex. They are pinnate, with ovate, deeply cut, blunt pinnæ or are often twice pinnate in the lower part.



A FRUITING PINNULE.

The lobes of the pinnules are frequently toothed, especially at the ends, and the rachis is green and narrowly winged.

The sori are borne on the lobes of the pinnules, usually on the outer basal lobe. The sporangia are clustered around a slender bristle which is a prolongation of a vein and are surrounded by a vase-like, slightly two-lipped involucre. In old fronds the bristles become long exserted and quite conspicuous and have obtained for the plant the name of bristle fern. It is called Killarney fern from the fact that it is found about the Lakes of Killarney.

All the species belonging to the Hymenophyllaceæ have very thin and delicate fronds and are commonly called filmy ferns. Frequently the blades consist of a single layer of cells. Although so delicate, the fronds

of our species last for several years, and commonly do not fruit until more than a year old. Instead of producing fresh sori yearly, the bristles simply elongate and bear new crops of sporangia at their bases. In the northern parts of its range the Killarney fern is usually found beneath overhanging ledges where there is unfailing moisture. Our illustration is from specimens collected at Havanna, Alabama, by Prof. Underwood.

Trichomanes Petersii.

This, the most diminutive of North American ferns, is found only in a small area in northern Alabama where it grows on the sides of dripping sandstone cliffs. It is so small that a silver quarter of a dollar will cover a whole colony. The rootstock is creeping, very small and threadlike, and the fronds, on the slenderest of stipes, seldom grow to be three-quarters of an inch long. They are about obovate with usually entire margins. The sori are borne on the apex of the fronds and surrounded by a slightly two-lipped involucre. The bristle-like receptacle is not exerted as in *radicans*. Our illustration is from specimens collected by Prof. Underwood.

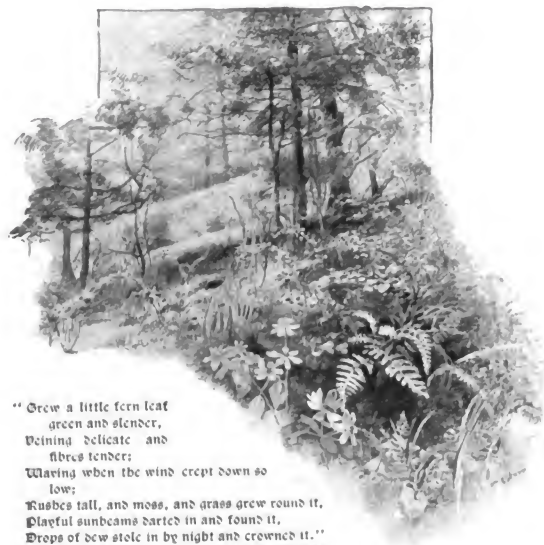


Trichomanes Petersii.
Natural size.

There are nearly two hundred species of filmy ferns in the world about evenly divided between the two genera *Trichomanes* and *Hymenophyllum*. They are found mostly in tropical regions in sheltered situations on wet rocks, the trunks of trees and on damp earth. Only the first mentioned genus is represented with us

and the two species here described are the only ones in North America north of Mexico. The generic name, *Trichomanes*, was an old Greek name for some fern. The reason for its application to this family of the filmy ferns is not apparent.

CONCERNING NOMENCLATURE.



"Grew a little fern leaf
green and slender,
Veining delicate and
fibres tender;
Waving when the wind crept down so
low;
Rushes tall, and moss, and grass grew round it,
Playful sunbeams darted in and found it,
Drops of dew stole in by night and crowned it."

—*M. B. Branch.*

CONCERNING NOMENCLATURE.



IN the scheme of the vegetable kingdom, ferns are accorded a place below the flowering plants. With the Fern-Allies—the club-mosses, quillworts and scouring rushes—they form the highest group of the so-called flowerless plants. On the one hand they are related to such simple flowering plants as the pines, palms, sedges and grasses, and on the other to the mosses and liverworts.

Among themselves they differ widely, and several natural groups may be recognised. Formerly these groups were all included in the single order *Filices*; but the modern and more scientific view makes them separate orders. One of the chief points of difference between them is found in the formation of the sporangia. In all but the most primitive, there is a ring of stronger cells extending around each sporange, which in most species bursts at maturity, scattering the spores. The position of this ring is of much importance in placing the genera in the proper orders. There are five of these orders represented in our fern-flora, four of which are relatively insignificant. Their principal characteristics and the tribes and genera they contain may be arranged in a series, from simple to complex, as follows. The relative size of the spore-cases are shown in the illustrations.

OPHIOGLOSSACÆ.



Sporangia without a ring formed of the interior tissues of the leaf, borne in spikes or panicles and discharging their spores through a transverse slit; fronds erect or inclined in veneration; roots usually fleshy; prothallia subterranean.

GENERA—*Ophioglossum*, *Botrychium*.

OSMUNDACEÆ.

Sporangia spherical on altered portions of the fronds, opening longitudinally; ring rudimentary; rootstock very large; fronds in circular crowns.

GENUS—*Osmunda*.



SCHIZÆACEÆ.



Sporangia egg-shaped, borne usually on a contracted portion of the frond, opening longitudinally; ring apical; rootstock short or creeping; rachis often twining.

GENERA—*Schizæa*, *Lygodium*.

HYMENOPHYLLACEÆ.

Sporangia sessile along a bristle like receptacle and surrounded by an urn-shaped or funnel-form, two-lipped involucre; ring transverse, opening vertically; rootstock creeping; fronds very delicate often but one cell thick.

GENUS—*Trichomanes*.



POLYPODIACEÆ.

Sporangia stalked, borne on the back or margin of the frond, opening transversely; ring vertical and elastic; rootstock short or extensively creeping; fronds scattered or clustered; prothallia green, not subterranean.



TRIBES AND GENERA.

TRIBE I.—POLYPODIEÆ. GENUS. *Polypodium*.

TRIBE II.—GRAMMITIDÆ. GENUS. *Notholana*.

TRIBE III.—PTERIDÆ. GENERA. *Adiantum*, *Pteris*, *Cheilanthes*, *Pellaea*, *Cryptogramma*.

TRIBE IV.—BLECHNEÆ. GENUS. *Woodwardia*.

TRIBE V.—ASPLENIEÆ. GENERA. *Asplenium*, *Athyrium*, *Scolopendrium*, *Camptosorus*.

TRIBE VI.—ASPIDIEÆ. GENERA. *Phegopteris*, *Aspidium*, *Polystichum*, *Cystopteris*, *Onoclea*, *Struthiopteris*.

TRIBE VII.—WOODSIEÆ. GENUS. *Woodsia*.

TRIBE VIII.—DICKSONIEÆ. GENUS. *Dicksonia*.

In the early days of botany, plants were named in a very loose and haphazard manner and several more or less descriptive words were usually combined to form the name of each species. These cumbersome titles were in common use until the time of Linnæus, but that acute naturalist perceiving the advantage of shorter and more exact names originated a system of naming both animals and plants in which the name of each kind consists of but two words; the first or group name standing for the family and the second or individual name standing for the species.

Linnæus was not the first to have a clear conception of genera and species, nor yet the first to give a double

name to a plant, but since he was the first to recognise the utility of a binomial system of nomenclature, and to establish such a system upon a sound basis, botanists have unanimously agreed to begin their nomenclature with the publication of his "Species Plantarum" in 1753. In this work was included every species of plant known to Linnæus and the names he there gave them are the ones botanists are supposed to use. One thing, however, has conspired to make a large number of changes in these names not only permissible but necessary. This is the broad view of genera taken by Linnæus. He placed all the ferns in a very small number of genera. In his genus *Polypodium*, for example, were placed species that are now found in *Cystopteris*, *Aspidium*, *Polystichum* and *Phegopteris*. Subsequent study convinced botanists that many of these species were distinct enough to be placed in separate genera and this was accordingly done, the generic name, of course, having to be changed in the process. Unfortunately for nomenclature, these botanists, working remote from one another, frequently made different genera for the same species without knowing it. Thus the rusty Woodsia was known to Linnæus as *Acrostichum Ilvense*, to Swartz as *Polypodium Ilvense*, to Michaux as *Nephrodium rufidulum* and to Willdenow as *Aspidium rufidulum*. Since we are supposed to always use the earliest name, it often becomes a nice question to decide which is first. Not only this, but different authors sometimes gave the same name to different plants unaware that it had been used before. Under these circumstances it has become necessary in exact science to add the name of the author to each combination of generic and specific names to show which species is meant.

While the generic name of a plant must necessarily be changed when it is transferred to another genus, there is no need of a change in the specific name unless the new genus should already possess a species of the same name. There cannot, of course, be two species of the same name in any genus. It has frequently happened, however, that botanists in transferring species have assumed the right to make new specific names. These names some botanists would discard for the oldest specific names without regard to the circumstances under which they were given, but there is a large body of students who look upon a plant as not named until it is placed in the right genus and hold that the first correct combination of generic and specific names is the proper name for the plant no matter by what other specific names it has been known. The name of the botanist who made the correct combination is then written after it. This is essentially the system that has been adopted in the nomenclature of the Check-List following the Keys to the Species in this volume.

When a plant originally described in one genus is transferred to another, it is the practice of many botanists to place in parenthesis after the specific name, the authority for that name, and to follow it with the name of the botanist who made the correct combination. Thus in the case of the rusty woodsia which is now cited as *Woodsia Ilvensis* (L.) R. Br., we are to understand that Linnæus gave the specific name *Ilvensis* to the plant, and that Robert Brown was the first to make the correct combination of generic and specific names.

The fern collector, interested in learning the names of his plants, pays little attention to the Orders. He is concerned with genera and species. Almost at once he

will be able to recognise the Order to which a given species belongs and later will seldom have to consult the Key for the genera, so noticeable do the family characteristics become. The advanced student can nearly always identify the growing fronds at a glance even when they are sterile, but the beginner will usually need good fruiting specimens to be sure of his species. It is best to collect the fertile fronds rather early, before the thin indusia have been disarranged or obliterated by the growing sporangia and if the sterile fronds differ noticeably from the fertile, they too should be collected. The rootstock, when not too large, should also be included.

With good specimens in hand, the beginner should be able to locate any of our ferns in the proper genus at once by carefully following the Key. To show its workings, let us suppose that the collector has found a specimen with rounded sori covered by a reniform indusium, which he wishes to identify. Turning to the Key he will observe that it branches somewhat like the veins of the ferns themselves, dividing again and again and each time more closely limiting the groups of species. It is first divided into two sections numbered I. and II. In one of these his species will be found. The first section contains only ferns with "sporangia in spikes, panicles or berry-like structures." His plant does not answer this description so he passes on to section II. with "sporangia on the under side of the frond." In this section are two lesser divisions each marked with two stars (**). The first contains only species without indusium and is passed by for the section with "indusium present." Here he finds several divisions all marked 4 and after reading them he decides that his plant belongs to the one that does not have its indusia "formed by the margin of the

frond." From the groups under this division marked *d* the one with roundish sori is selected and the division under it, with reniform indusium, shows his plant to be an *Aspidium*. Had the indusium been hood-shaped it would have been *Cystopteris*, if star-shaped, *Woodsia*, and so on. A simple magnifier costing from fifty cents to one dollar will be found exceedingly useful in making out the nature of the indusium and in examining other minute parts of the ferns.

The majority of our fern genera contain so few species that keys to them would be quite superfluous. For the larger genera, Keys have been given by which the species may be traced, just as the genera are in the large Key.

Few who get really interested in ferns can resist the temptation to make an herbarium. Upon this point the author's papers on "The Making of an Herbarium" may be consulted with advantage. To the student of ferns the herbarium is indispensable. It gives him material for study at times when it cannot be procured afield, and remains as a permanent record of much that would be lost if merely entrusted to the memory. In collecting for the herbarium or the fern garden, care should be taken not to carry away all of any rare species. No one is held in greater contempt by the true student than the vandal who ruthlessly destroys a station for a rare plant. It is well to remember the old rule "Of a little, take a little, and leave a little."

KEY TO THE GENERA.

"If it were required to know the position of the fruit-dots or the character of the indusium nothing could be easier than to ascertain it: but if it is required that you be affected by ferns, that they amount to anything, signify anything to you, that they be another sacred scripture and revelation to you, helping to redeem your life, this end is not so easily accomplished."—THOREAU.

KEY TO THE GENERA.

The most prominent characteristics are italicised.

SECTION I.

(Sporangia in spikes, panicles or berry-like structures.)

* FRUITING FRONDS WHOLLY FERTILE.

PAGE.



Schizaea

1. Fruit in a *one-sided* spike; plants very small; sterile frond *thread like*. Curly grass.

SCHIZÆA. 277



Osmunda

1. Fruit in a *club-shaped*, thrice pinnate, *woolly, brown* spike; fronds bipinnatifid; fruit *in early spring*. Flowering fern.

OSMUNDA. 25



Struthiopteris

2. Fruit in *berry-like* green structures, in a twice pinnate spike; fronds broad and coarse; rootstock creeping. Fruit *in late summer*. Sensitive fern.

ONOCLEA. 253

1. Fruit in nearly *cylindrical* slightly *notched* pinnæ; fertile frond pinnate; sterile tall, bipinnatifid; rootstock erect, fruit *late*. Ostrich fern.

STRUTHIOPTERIS. 257

* FRUITING FRONDS PARTLY STERILE.



Lygodium

2. Fruiting portion *in the middle* of the frond. Interrupted fern.

OSMUNDA. 30

2. Fruiting portion *at the apex* of the frond.

- a.* Sterile pinnae *palmate*; rachis *twining*. Climbing fern.

LYGODIUM. 280

- a.* Sterile pinnae *pinnate*; fronds large; fertile portion *green*, soon turning *brown*. Royal fern.

OSMUNDA. 32



Ophioglossum

2. Fruiting portion apparently on a *separate stalk*, above the sterile.

- b.* Sterile portion *entire*, thick; fertile, a simple *spike*. Adder's tongue.

OPHIOGLOSSUM. 45



Botrychium

- b.* Sterile portion more or less *divided*; fruit in *racemes* or *panicles* occasionally in spikes. Moonwort: Grape ferns.

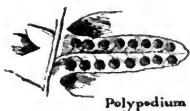
BOTRYCHIUM. 51

SECTION II.

(Sporangia on the under side of the fronds.)

** INDUSIUM WANTING.

PAGE.



- . Fruit-dot roundish, *large*; evergreen, rock species. Polypody.

POLYPODIUM. 196



3. Fruit-dots roundish, *small*; fronds *triangular*. Beech ferns.

PHEGOPTERIS. 200



3. Fruit *in lines on the margins* of the pinnules; under surface of the fronds covered with *whitish powder*.

NOTHOLÆNA. 288

** INDUSIUM PRESENT.



4. Sori on the edge of the pinnule; sporangia sessile at the base of a long *bristle-like receptacle* and surrounded by a *funnel form*, slightly two-lipped *involucre*. Filmy fern.

TRICHOMANES. 289



Pteris

4. Sori near the margins. Indusium formed by the reflexed edges of the pinnules.

c. Sporangia in a *continuous* line; fronds large, *ternate*; indusium narrow. Bracken. PTERIS.

PAGE.

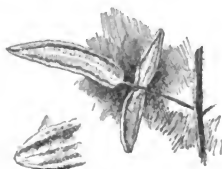
69



Adiantum

c. Sporangia in *oblong* or *lunate* sori, under a *reflexed tooth* of the pinnule; indusium broad; stipe and rachis *dark* and shining. Maiden-hair. ADIANTUM.

242



Pellaea

c. Sporangia in *roundish* masses.
† Indusium *broad, nearly continuous*; fronds smooth; stipes usually dark; rock species. Cliff brakes.

PELLÆA.

38



Cheilanthes

† Indusium *narrower, seldom continuous*, often *inconspicuous*; fronds usually hairy.

CHEILANTHES.

237



Cryptogramma

† Indusium of the *reflexed edges*, at first reaching nearly to the *midrib*, later nearly flat; fruiting pinnules, long, *podlike*; sterile fronds broad; stipes pale. Rock brakes.

CRYPTOGRAMMA.

287



Woodwardia

4. Sori various; indusium never formed of the margin of the frond.

d. Sori and indusium *oblong, parallel* with the midrib, somewhat *sunken* in the tissues of the frond; indusium opening toward the middle of the pinnules; water-loving species. Chain ferns.

WOODWARDIA. 216



Polystichum

- d. Sori and indusium *roundish*.

†† Indusium *peltate*, fixed by the *centre*; evergreen species in rocky woods. Shield ferns.

POLYSTICHUM. 106



Aspidium

- †† Indusium *reniform* or *cordate*, fixed by the *sinus*; large, mostly woodland species. Wood ferns.

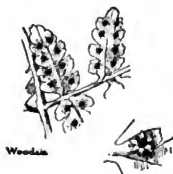
ASPIDIUM. 117



Cystopteris

- †† Indusium *hood-shaped*, attached to the frond by its broad base, *below* the sorus and arching over it, soon withering; moisture loving species. Bladder ferns.

CYSTOPTERIS. 209



Woodsia

- †† Indusium *star-shaped*, of a few irregular broad or narrow segments fixed *beneath* the sorus and enclosing it when young. Not easily seen in most species. Rock-loving plants usually somewhat chaffy.

WOODSIA. 93



Dicksonia

PAGE.

- †† Indusium *cup-shaped*, fixed beneath the sorus; sori minute on a tooth of the ultimate pinnules; fronds very finely cut. Boulder fern. . . . DICKSONIA. 229



Scolopendrium

- d. Sori and indusium *linear*.
††† Several times longer than wide, double; indusia opening toward each other; blade thick linear, *entire*. Hart's-tongue. SCOLOPENDRIUM. 268



Camptosorus

- ††† Shorter, some *parallel* to the midrib, others *oblique* to it, often in pairs or joined at the ends, irregularly scattered on the underside of the frond; blade *tapering* to a slender tip. Walking fern. CAMPTOSORUS. 265



Asplenium

- ††† Short, *straight* mostly *oblique* to the midrib, indusium usually narrow, opening toward the midrib; fronds lobed or variously divided. Spleenworts. ASPLENIUM. 155



Athyrium

- ††† Short; indusium more or less *curved* on the side attached to the frond, and when young usually extending across a vein; robust species. Lady fern. ATHYRIUM. 180

KEY TO THE GRAPE FERNS.

(Botrychium.)

	PAGE.
Plant large, fruiting in spring, sterile portion much divided	
<i>B. Virginianum.</i>	42
Plant smaller.	
Fruiting in autumn, sterile portion long stalked, triangular	
<i>B. obliquum.</i>	54
Fruiting in summer.	
Plant very fleshy, sterile portion with mostly lunate segments.	
<i>B. Lunaria.</i>	51
Plant less fleshy.	
Sterile portion short stalked, above the middle of the stem.	
<i>B. matricariaefolium.</i>	60
Sterile portion stalked usually below the middle of the stem.	
<i>B. simplex.</i>	58
Sterile portion sessile near the top of the stem.	
<i>B. lanceolatum.</i>	59

KEY TO THE WOOD FERNS.

(Aspidium.)

Fronds pinnate, the pinnæ pinnatifid.	
Blade thin, deciduous.	
Lower pinnæ reduced to mere lobes	
<i>A. Noveboracense.</i>	120
Lower pinnæ not or little reduced.	
Veins simple	
<i>A. simulatum.</i>	123
Veins forked	
<i>A. Thelypteris.</i>	117
Blade rather thick, evergreen.	
Fronds small, narrow, rock species	
<i>A. fragrans.</i>	147
Fronds large, two or more feet high.	
Lower pinnæ, nearly triangular	
<i>A. cristatum.</i>	139
Lower pinnæ longer.	
Sori close to the margin.	
<i>A. marginale.</i>	135
Sori nearer the midvein.	
Fond lanceolate	
<i>A. filix-mas.</i>	136
Fond ovate	
<i>A. Goldieanum.</i>	137
Fronds twice pinnate with lower pinnules pinnatifid.	
<i>A. Bootii.</i>	141
Fronds nearly thrice pinnate	
<i>A. spinulosum.</i>	143

KEY TO THE SPLEENWORTS.

(Asplenium.)

	PAGE.
Fronds pinnatifid or pinnate below, apex long tapering.	
Blade thick, lobes rounded <i>A. pinnatifidum.</i>	167
Blade thin, lobes pointed <i>A. ebenoides.</i>	169
Fronds pinnate.	
Rachis green or straw-coloured.	
Less than six inches high. <i>A. viride.</i>	158
Taller, pinnæ long pointed <i>A. angustifolium.</i>	188
Rachis dark.	
Pinnules not eared at base <i>A. Trichomanes.</i>	155
Pinnules eared at base.	
Mostly opposite <i>A. parvulum.</i>	159
Mostly alternate <i>A. ebenum.</i>	160
Fronds more than once pinnate.	
Stipes green, blades inclining to triangular pinnules fan-shaped. <i>A. ruta-muraria.</i>	162
Stipes darker below, blade longer and narrower <i>A. montanum.</i>	164
Stipes and rachis dark. <i>A. Bradleyi.</i>	166
(See, also, <i>Athyrium.</i>)	

KEY TO CHEILANTHES.

Fronds nearly smooth <i>C. Alabamensis.</i>	242
Fronds hairy, twice pinnate <i>C. vestita.</i>	237
Fronds tomentose, thrice pinnate.	
Very small species, stipe nearly smooth. <i>C. lanuginosa.</i>	240
Larger, stipes tomentose <i>C. tomentosa.</i>	239

KEY TO WOODSIA.

Stipe not jointed. <i>W. obtusa.</i>	96
Stipe obscurely jointed near the base.	
Frond more or less chaffy <i>W. Ilvensis.</i>	93
Fronds smooth or smoothish.	
Pinnæ ovate, deeply pinnatifid <i>W. glabella.</i>	99
Pinnæ rounded ovate, 5-7 lobed. <i>W. hyperborea.</i>	98

CHECKLIST OF THE FERNS OF NORTHEASTERN AMERICA.

(NORTH OF THE GULF STATES AND EAST OF THE
ROCKY MOUNTAINS.)

ADIANTUM L.

1. *Adiantum Capillus-Veneris* L.
2. *Adiantum pedatum* L.

ASPIDIUM Sw.

3. *Aspidium Boottii* Tuckerm.
Dryopteris Boottii Underw.
4. *Aspidium cristatum* Sw.
Dryopteris cristata A. Gray.
5. *Aspidium cristatum Clintonianum* D. C. Eaton.
Dryopteris cristata Clintoniana Underw.
6. *Aspidium cristatum x Marginale* Dav.
7. *Aspidium filix-mas* Sw.
Dryopteris filix-mas Schott.
8. *Aspidium fragrans* Sw.
Dryopteris fragrans Schott.
9. *Aspidium Goldieanum* Hook.
Dryopteris Goldieana A. Gray.
Aspidium Goldieanum f. celsum Palmer.
10. *Aspidium marginale* Sw.
Dryopteris marginalis A. Gray.
11. *Aspidium Noveboracense* Sw.
Dryopteris Noveboracensis A. Gray.
Aspidium Noveboracense f. fragrans Peck.
12. *Aspidium simulatum* Dav.
Dryopteris simulata Dav.

13. *Aspidium spinulosum* Sw.
Dryopteris spinulosa Kuntze.
14. *Aspidium spinulosum intermedium* D. C. Eaton.
Dryopteris spinulosa intermedia Underw.
15. *Aspidium spinulosum dilatatum* Hornemann.
Dryopteris spinulosa dilatata Underw.
16. *Aspidium Thelypteris* Sw.
Dryopteris Thelypteris A. Gray.

ASPLENIUM L.

17. *Asplenium angustifolium* Michx.
18. *Asplenium Bradleyi* D. C. Eaton.
19. *Asplenium ebeneum* Ait.
Asplenium platyneuron Oakes.
Asplenium ebeneum f. serratum A. Gray.
20. *Asplenium ebenoides* Scott.
21. *Asplenium montanum* Willd.
22. *Asplenium parvulum* Mart. & Gal.
23. *Asplenium pinnaatifidum* Nutt.
24. *Asplenium ruta-muraria* L.
25. *Asplenium Trichomanes* L.
Asplenium Trichomanes f. incisum Moore.
26. *Asplenium viride* Huds.

ATHYRIUM Roth.

27. *Athyrium thelypteroides* Desv.
Asplenium acrostichoides Sw.
Asplenium thelypteroides Michx.
28. *Athyrium filix-femina* Roth.
Asplenium filix-femina Bernh.
Asplenium filix-femina Michauxii Mett.

BOTRYCHIUM Sw.

29. *Botrychium lauceolatum* Angs.
30. *Botrychium Lunaria* Sw.

31. *Botrychium matricariæfolium* A. Br.
Botrychium neglectum Wood.
32. *Botrychium matricariæfolium tenebrosum*.
Botrychium tenebrosum A. A. Eaton.
33. *Botrychium obliquum* Muhl.
Botrychium ternatum obliquum Milde.
Botrychium obliquum f. intermedium D. C. Eaton.
34. *Botrychium obliquum dissectum*.
Botrychium ternatum dissectum Milde.
Botrychium dissectum Sprengel.
35. *Botrychium simplex* Hitchcock.
36. *Botrychium Virginianum* Sw.
Botrychium Virginianum f. gracile Pursh.

CAMPTOSORUS Link.

37. *Camptosorus rhizophyllus* Link.
Camptosorus rhizophyllus f. intermedius Arthur.

CHEILANTHES Sw.

38. *Cheilanthes Alabamensis* Kunze.
39. *Cheilanthes lanuginosa* Nutt.
Cheilanthes Feei Moore.
Cheilanthes gracilis Mett.
40. *Cheilanthes vestita* Sw.
Cheilanthes lanosa Watt.
41. *Cheilanthes tomentosa* Link.

CRYPTOGRAMMA R. Br.

42. *Cryptogramma acrostichoides* R. Br.

CYSTOPTERIS Bernh.

43. *Cystopteris bulbifera* Bernh.
Filix bulbifera Underw.
44. *Cystopteris fragilis* Bernh.
Filix fragilis Underw.
Cystopteris fragilis f. dentata Hook.

45. *Cystopteris montana* Bernh.
Filix montana Underw.

DICKSONIA L'Her.

46. *Dicksonia pilosiuscula* Willd.
Dicksonia punctilobula A. Gray.
Dennstaedtia punctilobula Moore.
Dicksonia pilosiuscula f. cristata Dav.

LYGODIUM Sw.

47. *Lygodium palmatum* Sw.

NOTHOLÆNA R. Br.

48. *Notholæna dealbata* Kunze.
Notholæna nivea dealbata Dav.

ONOCLEA L.

49. *Onoclea sensibilis* L.
Onoclea sensibilis f. obtusilobata Torr.

OPHIOGLOSSUM L.

50. *Ophioglossum vulgatum* L.
Ophioglossum vulgatum f. arenarium.
Ophioglossum arenarium E. G. Britton.
Ophioglossum vulgatum f. Engelmanni.
Ophioglossum Engelmanni Prantl.

OSMUNDA L.

51. *Osmunda cinnamomea* L.
Osmunda cinnamomea f. frondosa A. Gray.
52. *Osmunda Claytoniana* L.
53. *Osmunda regalis* L.

PELLÆA Link.

54. *Pellaea atropurpurea* Link.
55. *Pellaea densa* Hook.
56. *Pellaea gracilis* Hook.
Pellaea Stelleri Watt.
Cryptogramma Stelleri Prantl.

PHEGOPTERIS Fee.

57. *Phegopteris Dryopteris* Fee.
Phegopteris Dryopteris Robertiana Dav.
Phegopteris Calcarea Fee.
58. *Phegopteris hexagonoptera* Fee.
59. *Phegopteris polypodioides* Fee.
Phegopteris Phegopteris Underw.

POLYPODIUM L.

60. *Polypodium incanum* Sw.
Polypodium polypodioides Hitchcock.
61. *Polypodium vulgare* L.
Polypodium vulgare f. Cambricum Willd.
Polypodium vulgare f. biserratum Millspaugh.
Polypodium vulgare oreophilum Maxon.
Polypodium vulgare deceptum Maxon.

POLYSTICHUM Roth.

62. *Polystichum acrostichoides* Schott.
Aspidium acrostichoides Sw.
Dryopteris acrostichoides Kuntze.
Polystichum acrostichoides f. incisum Underw.
Polystichum acrostichoides f. crispum Clute.
63. *Polystichum Braunii* Lawson.
Aspidium aculeatum Braunii Doëll.
Dryopteris Braunii Underw.
64. *Polystichum lonchitis* Roth.
Aspidium lonchitis Sw.
Dryopteris lonchitis Kuntze.

PTERIS L.

65. *Pteris aquilina* L.
Pteridium aquilinum Kuhn.
66. *Pteris aquilina pseudocaudata* Clute.
Pteris aquilina caudata Hook.

CHECKLIST OF THE FERNS.

SCHIZÆA J. E. Smith.

67. *Schizæa pusilla* Pursh.

SCOLOPENDRIUM Adans.

68. *Scolopendrium vulgare* J. E. Smith.
Scolopendrium Scolopendrium Karst.
Phyllitis Scolopendrium Newman.

STRUTHIOPTERIS Willd.

69. *Struthiopteris Germanica* Willd.
Onoclea Struthiopteris Hoffm.
Matteuccia Struthiopteris Todaro.
Struthiopteris Germanica Pennsylvanica Lawson.

TRICHOMANES L.

70. *Trichomanes Petersii* A. Gray.
 71. *Trichomanes radicans* Sw.

WOODSIA R. Br.

72. *Woodsia glabella* R. Br.
 73. *Woodsia hyperborea* R. Br.
Woodsia alpina S. F. Gray.
 74. *Woodsia Ilvensis* R. Br.
 75. *Woodsia obtusa* Torr.
Woodsia obtusa f. glandulosa D. C. Eaton.
 76. *Woodsia Oregana* D. C. Eaton.
 77. *Woodsia scopulina* D. C. Eaton.

WOODWARDIA J. E. Smith.

78. *Woodwardia angustifolia* J. E. Smith.
Woodwardia areolata Moore.
 79. *Woodwardia Virginica* J. E. Smith.

LIST OF ABBREVIATIONS USED IN THE CHECKLIST OF FERNS.

A. Br. A. Braun.	L'Her. C. L. L'Heritier.
Adans. M. Adanson.	L. Linnæus.
Ait. W. Aiton.	Mart. & Gal. Martens & Galeotti.
Angs. J. Angstroem.	Mett. G. Mettenius.
Bernh. J. J. Bernhardt.	Michx. A. Michaux.
R. Br. Robert Brown.	Muhl. G. H. E. Muhlenberg.
Dav. Geo. E. Davenport.	Nutt. T. Nuttall.
Desv. N. A. Desvaux.	Sm. J. E. Smith.
Hoffm. G. F. Hoffman.	Sw. O. Swartz.
Hook. W. J. Hooker.	Torr. J. Torrey.
Huds. W. Hudson.	Underw. L. M. Underwood.
Karst. Karsten.	Tuckerm. E. Tuckerman.
	Willd. K. S. Willdenow.

GLOSSARY.

ACULEATE.—Armed with prickles.

ACUMINATE.—Tapering to a slender point.

ACUTE.—Pointed; ending in a sharp point.

ADVENTITIOUS.—That which comes from abroad; as a plant introduced by chance.

ADVENTITIOUS BUDS.—Buds produced without order on any part of the plant.

ANASTOMOSING.—Forming a network; as veins uniting with one another.

ANNULUS.—A ring, especially that which surrounds the spore-cases in most ferns.

ANTHERIDIA.—The male organs on the prothallium.

APICULATE.—Terminating abruptly with a small point.

ARCHEGONIA.—The female organs on the prothallium.

AREOLA (PL. AREOLÆ).—A space enclosed by anastomosing veinlets.

AREOLATE.—Having areolæ.

ARTICULATED.—Jointed or having the appearance of a joint.

AURICLED.—Eared.

AURICULATE.—With ear-like appendages.

BIPINNATE.—Twice pinnate.

BIPINNATIFID.—Twice pinnatifid.

BLADE.—The expanded, leafy portion of a frond.

BRISTLE.—A stiff hair; any slender outgrowth from the plant as in the fruiting parts of filmy ferns.

BULBIFEROUS.—Bearing little bulblets.

BULBLET.—A small bulb, especially such as are borne upon leaves or in their axils.

CAUDATE.—With a slender, tail-like appendage.

CAUDEX.—A trunk, especially that of a tree-fern.

CHAFF.—Slender, papery scales.

CHARTACEOUS.—Having the texture of parchment.

CHLOROPHYLL.—The green colouring matter of plants.

- CILIATE.—Fringed with fine hairs.
CIRCINATE.—Coiled, as the buds of ferns, from tip to base.
CLAVATE.—Club shaped.
COMPOUND.—Divided into two or more portions, said of the frond.
CONFLUENT.—Blended together.
CORDATE.—Heartshaped; ovate with a sinus at base.
CORIACEOUS.—Like leather in texture.
CRENATE.—With rounded teeth; said of margins.
CRENULATE.—Scalloped with small rounded teeth.
CROSIER.—An uncoiling frond.
CROWN.—The growing end of the rootstock or caudex.
CUNEATE.—Wedge shaped.
CUSPIDATE.—Terminating in a sharp, hard point.
DECIDUOUS.—Not evergreen; subject to being shed at certain seasons.
DECOMPOUND.—Several times compounded or divided.
DECUMBENT.—Not erect; bending along the ground.
DECURRENT.—Extended downward along the rachis; said of the bases of pinnae, etc.
DEFLEXED.—Bent abruptly downward.
DENTATE.—Toothed; said of the margins.
DENTICULATE.—Finely toothed.
DEPAUPERATE.—Starved; prevented from coming to its natural size through lack of nourishment.
DICHOTOMOUS.—Forked in pairs; two forked.
DIMIDIATE.—Halved, or as if one half was wanting, as in the pinnules of some *Adiantums*.
DIMORPHOUS.—Of two forms; said of ferns whose fertile and sterile fronds are not alike.
DISSECTED.—Cut into many lobes or divisions.
ELLIPTICAL.—Oblong with rounded ends.
EMARGINATE.—Notched at the summit.
ENTIRE.—Not divided; said of fronds or pinnules whose margins are without notches or teeth.
FALCATE.—Scythe shaped; curved upward.
FERTILE.—Producing spores.
FLABELLATE.—Fan-shaped.
FILIFORM.—Threadlike.

FOVEOLATE.—Honeycombed.

FROND.—A fern leaf. Properly the word frond includes both *stipe* and *blade*, but frequently it is used simply to designate the leafy portion.

FRUIT.—Sporangia.

FRUIT-DOT.—A sorus.

FUGACIOUS.—Short-lived ; falling early.

GLABROUS.—Smooth.

GLAND.—A minute globular or pear-shaped organ which usually secretes a resinous, waxy, gummy or aromatic product.

GLANDULAR.—Furnished with glands.

GLAUCCOUS.—Covered with a very fine, powdery substance, as plums are.

GLUTINOUS.—Covered with a sticky exudation.

HABIT.—The general appearance of a plant.

HABITAT.—The natural dwelling place of an animal or plant.

HIRSUTE.—Having coarse stiff hairs.

IMBRICATED.—Overlapping or breaking joints like shingles on a roof.

INCISED.—Cut into deep sharp teeth.

INDUSIUM (PL. INDUSIA).—The thin, scale-like covering of immature sori.

INVOLUCRE.—The cup-shaped processes surrounding the sporangia in the filmy ferns ; an indusium.

LACINIATE.—Cut into deep, narrow, irregular lobes ; slashed.

LANCEOLATE.—Rather narrow and tapering to the apex ; occasionally tapering at base also.

LAMINA.—A blade ; the leafy portion of a frond.

LINEAR.—Long and narrow.

LOBE.—One of the small divisions of a frond.

LUNATE.—Shaped like a half-moon.

MARGINAL.—Situated on, or close to the margin.

MEMBRANACEOUS.—Like a membrane ; very thin and flexible.

MIDRIB.—The prolongation of the stipe through an undivided frond or pinna.

MIDVEIN.—The principal vein in a pinnule or segment.

MUCRONATE.—Having the midvein prolonged beyond the pinnule forming a point.

OBLANCEOLATE.—The reverse of lanceolate ; broadest near the apex.

OBLONG.—Two or three times longer than broad.

OBOVATE.—The reverse of ovate.

OBTUSE.—Blunt ; without point.

ORBICULAR.—Circular.

OVATE.—Egg-shaped ; the broadest part near the base.

PALEACEOUS.—Clothed with chaff.

PALMATE.—With spreading divisions like the fingers of the hand.

PANICLE.—A cluster of fruit in which the stems branch more or less.

PAPYRACEOUS.—Paper-like.

PEDICEL.—A tiny stalk ; especially the stalk of the sporangia.

PELTATE.—Shield-shaped ; said of scales and indusia that are attached to the frond by their centers.

PERSISTENT.—Not falling away ; remaining on the plant.

PETIOLE.—Same as stalk and stipe.

PINNA (PL. PINNÆ).—One of the primary divisions of a frond.

PINNATE.—Consisting of several leaflets arranged on each side of a common petiole or rachis.

PINNATIFID.—Divided in a pinnate manner, but with leaflets not entirely separate.

PINNULE.—One of the small divisions of a pinnate leaf.

PROCUMBENT.—Lying along the ground.

PROLIFEROUS.—Giving rise to new plants.

PROTHALLIUM (PL. PROTHALLIA).—The minute scale-like growth from the spore of a fern.

PUBESCENCE.—A covering of soft, short hairs.

PUBESCENT.—Covered with fine, soft hairs.

QUADRIPINNATE.—Four times pinnate.

RACHIS.—The continuation of the stipe through a compound frond.

RECEPTACLE.—The part of the frond to which the sporangia are attached, especially in the Filmy Ferns.

REFLEXED.—Abruptly bent downward or backward.

RENIFORM.—Kidney shaped.

REVOLUTE.—Rolled backward, as the margins of some fronds.

RHIZOME.—An underground stem ; a rootstock.

ROOTSTOCK.—Same as rhizome. The portion that produces the fronds in most of our species.

SCALES.—The chaff on the stems of ferns.

- SCANDENT.—Climbing.
- SEGMENT.—One of the smaller divisions of a pinnatifid frond.
- SERRATE.—With sawlike teeth ; said of margins.
- SESSILE.—Without a stalk.
- SINUATE.—Wavy ; said of margins.
- SINUS.—The re-entering space between two lobes.
- SORUS (PL. SORI).—An assemblage of sporangia ; a fruit dot.
- SPATULATE.—Spoon-shaped.
- SPINE.—A sharp point ; a thorn.
- SPINULOSE.—Thorny ; set with small spines.
- SPORANGE (PL. SPORANGIA).—A tiny globe in which the spores are produced.
- SPORE.—A one-celled body, the fruit of the higher cryptogams ; it is produced asexually and is the analogue of a seed.
- SPORECASE.—Same as sporange ; the case in which the spores are borne.
- STALK.—Same as stipe.
- STERILE.—Barren. Said of fern leaves that do not produce spores.
- STIPE.—The petiole or stalk of the fern leaf which bears the leafy portion aloft.
- STOLON.—A trailing, or often underground, branch.
- SUBULATE.—Awl-shaped.
- TERNATE.—With three nearly equal divisions.
- TOMENTOSE.—Covered with matted wool.
- TOMENTUM.—Close matted woolly hairs.
- TOOTH.—The smallest divisions of the fronds.
- TORTUOUS.—Bent or twisted in different directions.
- TRIPINNATE.—Three times pinnate.
- TRUNCATE.—Appearing as if cut off abruptly.
- UNDULATE.—Wavy-margined.
- VASCULAR.—Containing vessels, ducts, etc., as the stems of ferns.
- VEIN.—One of the small branches in the framework of a leaf.
- VENATION.—The manner in which the veins are arranged in the leaf.
- VERNATION.—The arrangement of leaves in the bud.
- VIVIPAROUS.—Producing young upon various parts of the plant.
- WINGED.—Bordered with tissue as the rachis of some ferns.

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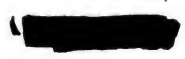
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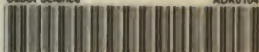


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